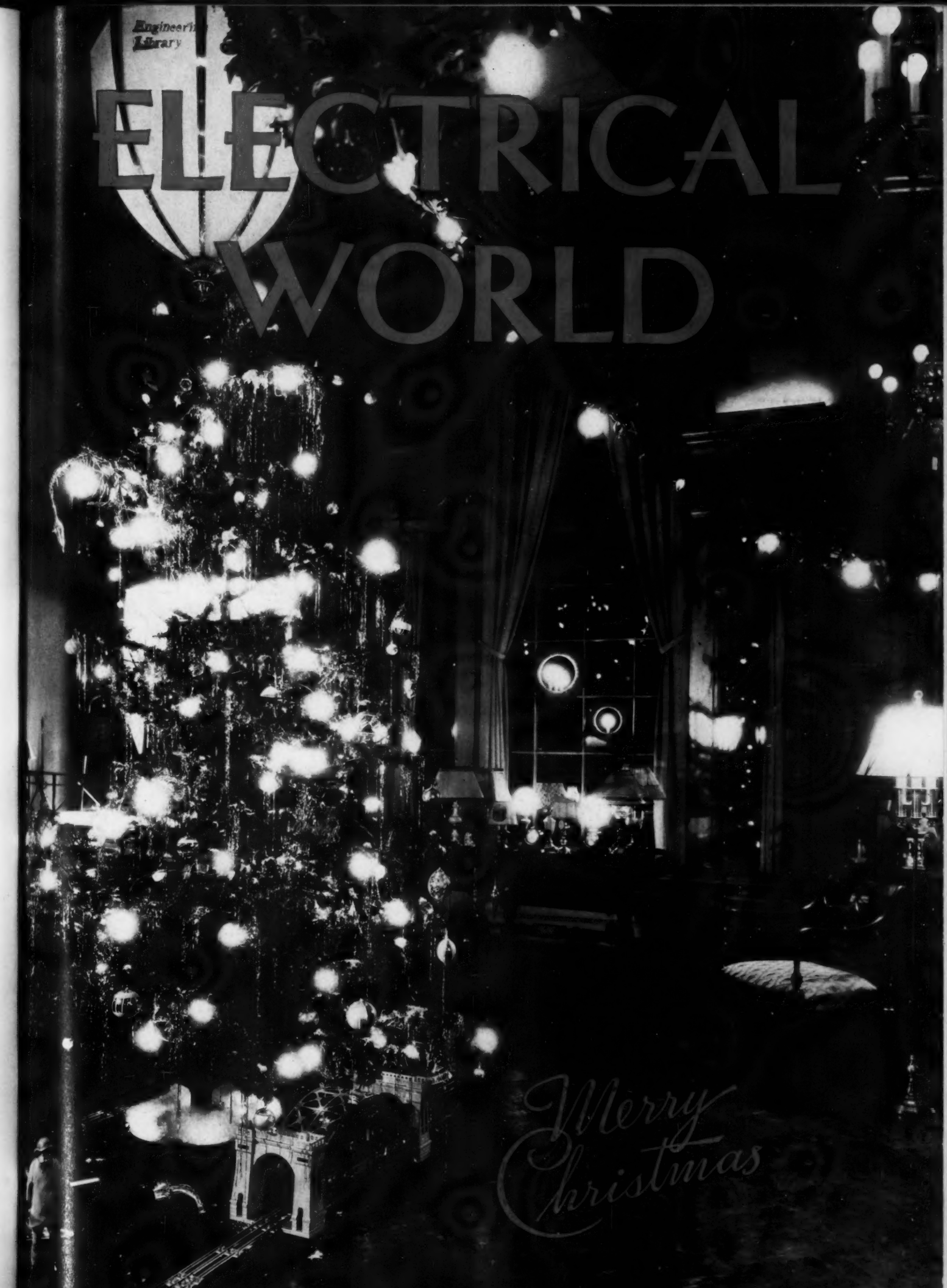
Engineering Library

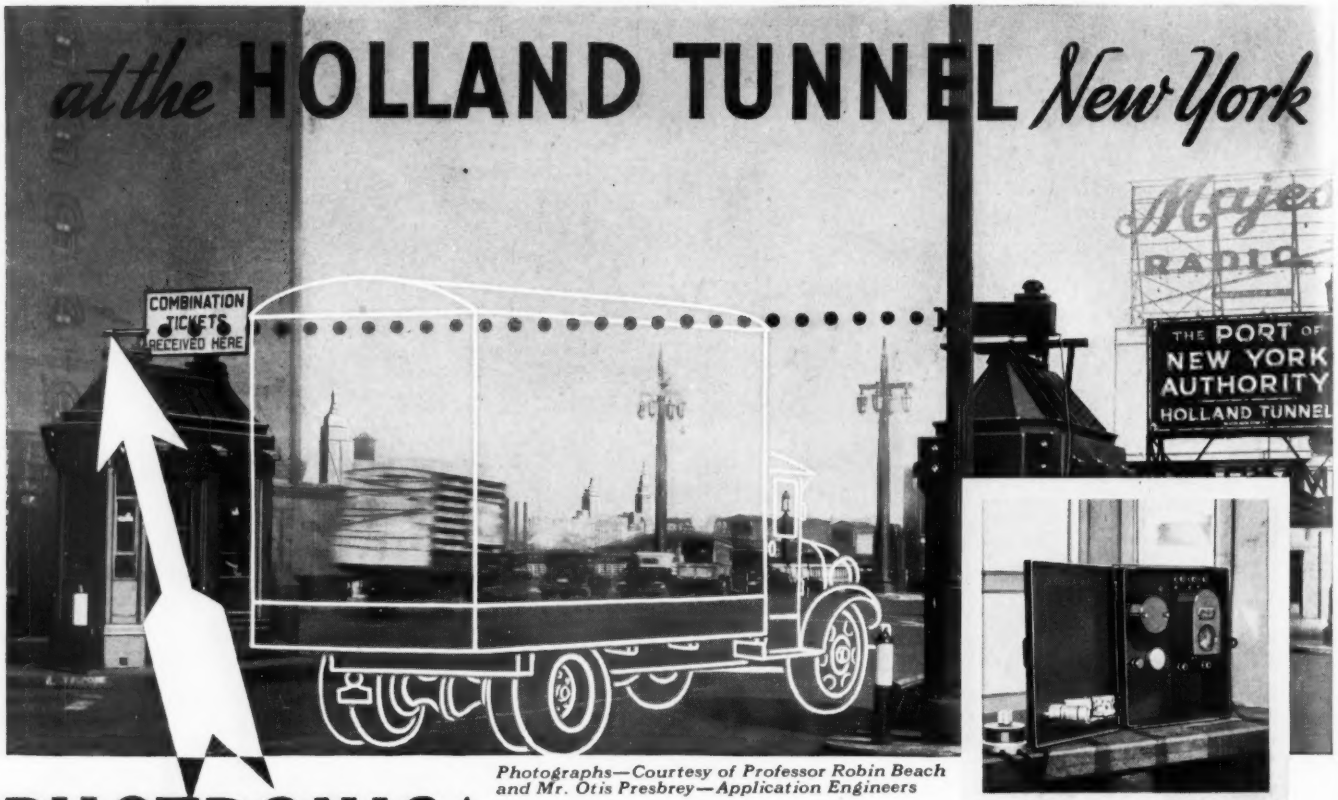
ELECTRICAL WORLD



ty-five Cents Per Copy McGraw-Hill Publishing Company, Inc. DECEMBER 24, 1932

PUTTING LIGHT TO WORK

at the HOLLAND TUNNEL *New York*



Photographs—Courtesy of Professor Robin Beach and Mr. Otis Presbrey—Application Engineers

PHOTRONIC* PHOTO ELECTRIC CELL *Stops the High Ones*

Interesting Notes on Truck Height Detection at the Holland Tunnel

1. The PHOTRONIC★ photoelectric Cell equipment sounds the alarm when an obstruction as narrow as one inch intercepts the light beam at a speed rate up to 25 miles per hour.

2. The lamp which supplies the light beam across the roadway through a special condenser system, is operated at a reduced voltage in order to increase the life of the lamp filament. The lamp has been in continuous operation for over 5,000 hours.

3. The PHOTRONIC★ photoelectric Cell equipment is provided with compensation for excessive smoke conditions due to the proximity of railroads. This compensation circuit renders the cell auxiliaries equally sensitive under clear or excessive smoke conditions.

4. The PHOTRONIC★ photoelectric Cell and its auxiliary relay equipment has continued to withstand the jarring due to severe road shocks caused by the heavy trucks approaching and leaving the toll booths under conditions of high acceleration.

5. The Cell and auxiliary apparatus has functioned continuously under severe weather conditions ranging from very cold stormy weather of the late winter to the most extreme heat of the summer months.

•

★PHOTRONIC—a copyrighted name used to designate the photoelectric cells and photoelectric devices manufactured exclusively by the Weston Electrical Instrument Corporation.

For the past eight months, Weston PHOTRONIC★ photoelectric Cells have been working continuously twenty-four hours a day at the Port of New York Authority's famous Holland Vehicular Tunnel. Since installation, they have not required maintenance, replacement or adjustment other than cleaning lens of Light Source.

Their function is to prevent vehicles whose height exceeds 12 feet, 6 inches from entering the Tunnel.

A light beam 12 feet, 6 inches, above and parallel to the ground, is projected 32 feet across the roadway to a PHOTRONIC★ photoelectric Cell. An overhigh vehicle, in passing, intercepts the beam, causing the PHOTRONIC★ photoelectric Cell to operate an alarm. *Obstructions, even as small as one inch wide, intercepting the beam at a speed as fast as 25 miles per hour, operate the alarm.*

In this application, eight months of continuous, trouble-free performance in all kinds of weather proves that the Weston PHOTRONIC★ photoelectric Cell is a practical, reliable device . . . a dependable, automatic control for Industry to put to work.

For more information—Circulars describing the PHOTRONIC★ photoelectric Cell and PHOTRONIC★ Relays for counting, sorting, limit measurement, illumination control, etc., gladly sent on request.

WESTON

Fourteen months ago, Weston made astounding *claims* for the PHOTRONIC★ photoelectric Cell. Every day more actual performance records substantiate those claims. They have proved the PHOTRONIC★ photoelectric Cell a reliable, simple, economical means of control.

ELECTRICAL INSTRUMENT CORPORATION

578 FRELINGHUYSEN AVENUE . . . . . NEWARK, N. J.

ELECTRICAL WORLD

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N. Y. Power Authority Seeks Distribution Cost Facts

Bravely rushing in precipitously, where others have entered with more humble tread only to emerge without having found a way to reduce a complicated problem to an easy-to-apply formula, the Power Authority of the State of New York announces that: "New light will be thrown on the unexplored field of the cost of electrical distribution at the sessions of the Institute of Public Engineering to be held on January 20, under the auspices of the Power Authority of the State of New York, in co-operation with the Public Service Commissions of the District of Columbia, New York and Pennsylvania."

It is announced also that the method of inquiry to be pursued at the sessions is as novel as the field that is to be explored. Hitherto public service commissions have conducted their investigations primarily by public hearings or other similarly controversial methods. This group of commissions now proposes, in co-operation with engineering authorities and leaders of the public utility industry, to adopt the methods which the professional and scientific associations have developed as a result of their experience. Only "accredited engineers and economists" will participate in the program, but this stipulation is open to various interpretations.

"The primary purpose of the institute is to establish a foundation upon which the costs of domestic electric service, including rural distribution, can be accurately and scientifically determined," the announcement states.

"Domestic electric service costs are readily divided into two classes: First, there is the cost of the current, generated and transmitted at high tension to the local substation and, second, the cost of distributing this current locally over low-tension wires to domestic and rural consumers.

Has not the time come when, in the bondholder's own interest and in the public interest of preserving the financial stability of the railroads of the country, sacrifices must be made, voluntarily, by the investors in the fixed securities of the carriers?

DAVID E. LILIENTHAL
Member
Wisconsin Public Service Commission

[Addressing the Railroad Brotherhoods of Wisconsin last week, Mr. Lilienthal further averred: "If this is not done what other alternative is there but widespread receiverships and the consequent scaling down of fixed charges by involuntary adjustments?"]

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"About the cost of generating and transmitting electricity there is a wealth of information. But about the cost of local distribution almost nothing is accurately known. There is not a single generally recognized standard of electrical distribution performance. There is no literature of distribution cost engineering and there has been no forum where the subject has been scientifically discussed."

The Power Authority is acting upon an assumption of duty through charge by the state Legislature to determine the costs of domestic electric service as a basis for negotiating equitable contracts for the distribution of the electric power to be generated on the St. Lawrence River.

Pipe Line Pumping Advances Topic of Power Engineers

At the fourth annual conference of the Petroleum Electric Power club held in Oklahoma City last week co-operation between the petroleum industry and the electrical industry was seen as solving their mutual problems in power application. Speakers stressed the importance of the development of new equipment which would enable the electrical industry better to serve oil fields.

W. H. Stueve, power engineer for the Oklahoma Gas & Electric Company, discussed the latest developments in the use of centrifugal pumps for oil and gasoline line pumping, explaining the practicability of the use of motor-driven centrifugal gas compressors, proved by test in the Kansas field.

Most recent developments involve the "Rannett" pump, in which the oil or gasoline is passed through a housing surrounding the motor on the suction side for cooling and increasing the efficiency of the motor and then passed to the eight-stage centrifugal pump, and the use of typical centrifugal pump units motor driven or the use of the "Rannett" pump, but generating power at the station site with internal combustion engines and generators. These improvements, according to Mr. Stueve, are designed to increase the efficiency and provide an economical means of pipe line pumping for the petroleum industry.

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Storm Brings Down Alabama Lines

Snow and sleet in the Southeast in last week's storm brought down six 110,000-volt lines of the Alabama Power Company and interrupted many distribution circuits. Between 150 and 200 former employees of Alabama Power were called upon for emergency duty. Temporary service was restored in most cases within a few hours.

Bankers Deny They Knew Insull Status in Accepting Collateral to Secure Loans

THERE was a tough struggle, this week and last, to prove that astute New York bankers knew anything of the condition of Insull affairs at the time of making the loans for which collateral was pledged, to prove that there was knowledge that the collateral was in reality already allocated as the basis for certain debentures, to prove, in fact, anything at all. At hearings in New York before John E. Joyce, federal referee, Lewis F. Jacobson, who is conducting a bankruptcy examination under an order of the federal court in Chicago, sought to demonstrate on behalf of investors who put $60,000,000 into debentures of Insull Utility Investments, Inc., that seven New York and Chicago banks and the General Electric Company, of which Owen D. Young is chairman, knew that Samuel Insull was insolvent last year when they granted to him his last loans and took as collateral the last of his stocks, which he never was able to redeem.

One of the first witnesses, Robert E. Broome, vice-president of the Guaranty Trust Company of New York, testified that when the Guaranty Trust Company first granted its $5,000,000 loan to Insull Utility Investments in May, 1931, he assumed that this represented a transfer of a loan from a Chicago bank, but that he had nothing upon which to base this conjecture. Even in renewing the loan, according to Mr. Broome, there was no inquiry as to the condition of Insull Utility Investments, as to whether its operations were profitable or not, as to the amount of money it owed, or as to other specific matters relating to the company. Mr. Broome maintained that the first time he had definite knowledge of the number of other banks which had lent money to the Insull organization was when Samuel Insull, Jr., in response to a request for additional margin due to the decline in value of the collateral on the market, revealed that it was impossible to provide further collateral and asked that the Guaranty Trust Company abstain from throwing its collateral on the market.

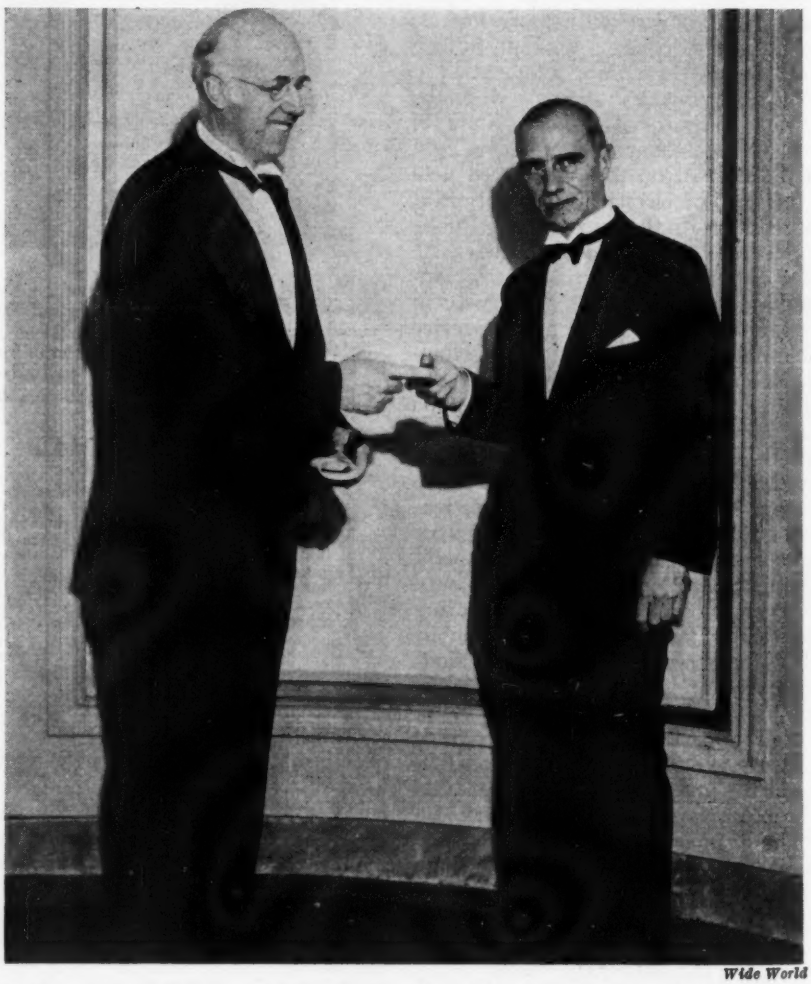
Other bankers plead ignorance

Subsequently, Herbert P. Howell, president of the Commercial National Bank & Trust Company, and H. A. Mathews and Arthur W. Hutchins, vice-presidents of the Irving Trust Company, were questioned by Mr. Jacobson. They testified that Samuel Insull, Jr., accompanied by Harry L. Stuart of Halsey, Stuart & Company, which had been active in arranging the Insull financing, visited the New York banks which were calling for more collateral and proposed a moratorium of six months, during which the bankers were not to dump the Insull collateral on the market. Because of friction between the New York and Chicago bankers, revealed in the testimony, there was no agreement on the "standstill," but the leadership of Owen D. Young held them together until a meeting could be called. Mr. Mathews of the Irving Trust, with loans of $5,000,000, testified that he was not aware the utility investment company was insolvent in December, even when Mr. Insull told him it had no more collateral to put up, and further that he did not know it had already put up with his bank collateral which really belonged to the Middle West Utilities Company.

Mr. Howell, president of the Commercial National Bank & Trust Company, with a loan of $1,500,000, said he did not know about the restrictive clause in the $60,000,000 issue of debentures of the Insull Utility Investments dated January 1, 1930, which convenanted to set up no more indebtedness when the outstanding total reached 50 per cent of the corporation's assets. Circulars, advertisements in newspapers which, he said, he habitually read, and a booklet on the Insull group, emphasizing this feature of the debentures, were shown to him, but he said this feature of the debentures had never come to his notice.

Speaking as chairman of the General Electric Company, Owen D. Young testified that he gladly obliged Mr. In-

MR. LIVERSIDGE RECEIVES THE McGRAW AWARD



Wide World

Before an audience of 600 H. P. Liversidge received the James H. McGraw Award for Co-operation last week ("Electrical World," December 17, page 802). Earl Whitehorne of the McGraw-Hill Publishing Company presented the medal, certificate and purse to Mr. Liversidge, who is vice-president of Philadelphia Electric Company and president of the Electrical Association of Philadelphia. The co-operative actions recognized were in utility-contractor-dealer relationships for more active merchandising.

sull whenever possible because he was the best customer of the General Electric Company and because he was a friend of twenty years' standing. When Insull Utility Investments was formed, in 1929, Mr. Young said he invested $50,000 in the undertaking, which he later raised to about $175,000 with restrictions against resale. During the next three years Mr. Young said he paid no attention to the investment and did not even read the annual reports of the company, which he supposed he must have received as a stockholder. He disclaimed any knowledge of the situation until Mr. Insull asked him, shortly after the General Electric Company had extended a loan of $2,000,000, to intervene with bankers who were pressing for more collateral. His attempt to save Insull Utility Investments consisted in urging the New York and Chicago bankers to a moratorium agreement proposed by Mr. Insull, whereby loans would be carried until August, 1932, without selling out the collateral. "The most you can say about that old man," concluded Mr. Young, "is that he had too much confidence in this country and in his own companies."

Insolvency knowledge denied

William Gray, vice-president of the Central Hanover Bank & Trust Company, maintained on the witness stand that the bank did not know it was taking the assets of an insolvent corporation when it made one of the last loans to Insull Utility Investments, Inc., and took as collateral the stocks of the operating companies which Samuel Insull was accumulating in the portfolio of his investment corporation to stabilize his control of the entire Insull system. According to Mr. Gray's testimony, the Central Hanover lent $5,000,000 to the now bankrupt Insull Utility Investments in June, 1931, and renewed the loan on $4,000,000 in September when Mr. Insull paid off $1,000,000. As security were given stocks of the Commonwealth Edison Company, People's Gas Light & Coke, Public Service Company of Northern Illinois and Middle West Utilities Company, at a then market value of 40 per cent in excess of the face of the note. He said that he made no extra attempt at any time to find out what the state of solvency of the company was, relying entirely on the collateral.

In his cross-examination of the bankers and of Mr. Young Mr. Jacobson tried to prove that the banks and the General Electric Company knew what they were doing and held off the receivership until they were outside the period during which the bankrupt's assets might be recovered from them. It is on this theory that the informal moratorium was an evasion of the bankruptcy law, Mr. Jacobson informed Referee Joyce, that he hopes to make the bankers return to the debenture holders the Insull operating control represented by the stocks which they still hold as forfeited collateral. The hearings were adjourned to January 4, when Gerard Swope, president of the General Electric Company, will be questioned. According to Mr. Young's testimony it was not his own duty, but Mr. Swope's to inquire into the ability of the Insull corporations to pay interest on the $2,000,000 General Electric loan and into the value of the collateral behind it.

Holiday Season Slows Industrial Activity

Entering the holiday doldrums, business can but look forward to the first quarter of 1933 with whatever hopes it can muster. Though unemployment be now on the increase, conditions are far more stable than in 1930 or 1931. One compilation shows January to have witnessed increased employment in every year of the past decade except 1925, while February has in every year shown increases over January, with a peak to be reached in March eight years out of ten.

November figures for industrial activity, as reflected in energy use in the "Electrical World" compilation, show a slight improvement over October and represent, for the first time since 1929, three months of consecutive gains.

Current figures on general volumes of trade are, as is to be seasonally anticipated, not encouraging. Carloadings off; steel output at 14 per cent of capacity; energy production goes up, however. Automobile production, for show and dealer stocking, has leaped upward to nearly the highest point in eighteen months. November registration of new cars was definitely higher.

Prices continue weak, due, in the case of commodities, to the depreciation of sterling, which, after all, to a large and uncontrollable measure, affects prices here.

Public utility construction in November totaled $4,116,300, as compared with $8,264,100 in October and $9,235,000 in November of last year. For the first eleven months it showed a contract volume of $69,150,800, as against $284,699,800 for the same period of 1931.

Christmas buying appears to have swept along to a good finish, although the first half of December in retail sales was notably slow.

By one of those grim jests which life now and then perpetrates, it turns out that France need never have defaulted: that the necessary appropriation of funds was voted last March by the legislative bodies of the republic, and that not one of whatever number of Frenchmen and experts and officials there are could remember this trifling matter on which the stability of a world to some measure depends.

Wisconsin Commissioner Would Strengthen Laws

At state budget hearings held last week Theodore Kronshage, Jr., chairman of the Wisconsin Public Service Commission, advocated legislation that will strengthen utility and securities regulations in that state. Among the recommendations are the authorizing of the Public Service Commission to levy costs of utility investigations up to 1 per cent of the gross revenues of the investigated utility, instead of one-half of 1 per cent as the law now stands; requiring utilities to pay such assessments by the commission before they begin court action protesting the assessments, and increasing fees charged by the securities division to make it self-sustaining.

"There has not been a real audit of Wisconsin utilities since the commission was organized," Mr. Kronshage said. "There should be such an audit."

Utility Purchases and Sells Energy in Mine Contract

Distinctly unusual but, it is said, economically sound and profitable for both parties, a large Eastern utility has contracted with a coal mining company for the purchase of all the energy that the mining organization can generate with waste and ordinarily unsalable output and also to sell the mining company all of the energy used in its various operations.

This arrangement in no sense is an interchange or trade of energy for the utility receives all the energy generated, paying for it on the basis of an amount equivalent to what it saves in capacity and energy charges as a result of having this amount of firm power available. The utility is paid for all the energy used by the coal mine at the regular rates for such service. None of the energy produced by the utility customer is used by the latter except after passing through the outgoing meter to the utility company's lines and the incoming meter to the mine switchboard.

The arrangement has advantages for both the coal operator and utility, permitting the use of otherwise waste fuel and obviating the necessity for increased generating capacity. An important factor is that refuse coal is only disposed of as such at some operations at a cost as high as 50 cents a ton. The power supplied by the mine is firm power, in the sense that it is only produced when the mine and, in general, other mines in the same territory are operating.

Coming Meetings

American Association for the Advancement of Science—Annual convention, Atlantic City, N. J., Dec. 27-31. C. F. Roos, Smithsonian Institution, Washington, D. C.

American Physical Society — Annual meeting, Atlantic City, Dec. 28-30. W. L. Severinghaus, Columbia University, New York.

American Engineering Council—Washington, D. C. Jan. 15. L. W. Wallace, 744 Jackson Place, Washington, D. C.

American Institute of Electrical Engineers—Winter convention, New York, Jan. 23-27. H. H. Henline, 33 West 39th Street, New York.

Great Lakes Division, N.E.L.A. — Fifth annual sales conference, Chicago Feb. 16-17. T. C. Polk, 20 No. Wacker Drive, Chicago.

National Accounting Section, N.E.L.A. Committee meetings, Chicago. Feb. 20-21. A. J. Marshall, 420 Lexington Ave., New York.

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Empire District Valuation Before Missouri Commission

Declining costs of wire, transformers and other equipment in the past two years necessitate an 11.7 per cent reduction in the valuation of Southwest Missouri properties of Empire District Electric Company, an H. L. Doherty subsidiary, the Missouri Public Service Commission was told by its engineers, who have completed a revised appraisal, at the resumption of hearings on the subject last week. The hearing, originally scheduled for last December, has been continued from time to time to permit a revaluation of the utility properties based on present prices (ELECTRICAL WORLD, March 26, 1932, page 562).

J. E. Flanders, chief engineer for the commission, and Guido Moss, engineer in charge of the appraisal, testified that their estimate of two years ago had been cut from $18,320,406 to $16,182,691 as of January 1, 1932. The difference of nearly $10,000,000 between investment cost as carried by the Doherty company and the commission's appraisal made public in September, 1931, is expected to be the chief bone of contention in the present hearing.

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Holding Company Control Held Unwise in Massachusetts

Unwarranted confusion of holding company problems with public utility regulation might be the result of federal or state legislation to control the former type of corporation, said the Massachusetts Department of Public Utilities last week in its annual report to the forthcoming General Court. Any attempt to regulate the holding company as though it were an operating company is foreseen as impairing the main object of public utilities regulation, which is reasonable rates, efficient service and no discrimination.

"Whenever the federal or state government undertakes the regulation of holding company securities and financial operations," declared the commission, "countenance will be given to the thought that the consumer should pay rates sufficient to sustain the value of holding company securities so regulated, and whose sole value ought usually to be that of the securities of the operating companies which it owns and upon which its securities are pyramided. Apart from the regulation of the operating company in its dealings with holding companies, we think the evils arising from the activities of the holding companies should be dealt with as a blue sky problem or by criminal law."

The commission seeks: power to supervise utility borrowings in excess of 20 per cent of capital par value plus premiums; required filing of holding company contracts embodying fees by operating companies; relaxation of laws permitting municipalities to embark in the lighting business, and some control over borrowing money payable in three years or less.

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Potomac Edison Protests Commission Valuation

Protest of the valuation placed on its properties by the Maryland Public Service Commission has been filed by the Potomac Edison Company, which claims that erroneous methods were used, numerous errors and omissions were made and, in connection with the electric department of the company, large amounts of property which are used by the electric department were allocated to the railway department. The commission is asked to withdraw the valuation and make the corrections sought by the company. The commission fixed $15,682,043 as the valuation for all the properties, the electric properties having been valued at $11,616,072 (ELECTRICAL WORLD, December 10, page 772). The case has been before the commission for about two years, most of this time being required to inspect the properties in a large number of communities. A date to hear the company's claims will be set by the commission.

Rate reductions instituted

In the meantime a reduction of one-half cent per kilowatt-hour in all the primary electric domestic rates throughout substantially all the territory served, with the exception of Hagerstown, Md., has been agreed to by the company. It is claimed that the reduction will mean a saving of approximately $85,000 a year to the customers of the company receiving household service. The reduction is to be applied on bills rendered on and after January 11, 1933. The Hagerstown rate remains the same as that of the municipal plant in that city. It was pointed out by the commission that this arrangement between the company and the commission does not stand in the way of a further reduction, if one is found to be justified, when a formal hearing is held.

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Commission's Jurisdiction Curbed in New Mexico

According to a recent decision of the New Mexico Supreme Court the State Corporation Commission has no jurisdiction over the rates of gas and electric utilities. The decision was rendered on an appeal from an order of the commission in the complaint of La Follette, et al., versus the Albuquerque Gas & Electric Company. A similar ruling was made in the case of Citizens of Santa Fe versus New Mexico Power Company. The state constitution contains a section giving the commission power to regulate and control the rates of railroad, express, telegraph, telephone, sleeping car and other transportation and transmission companies and common carriers. The court held that "we are unable to persuade ourselves that the constitution makers meant to include local gas and electric light companies under the phrase 'other transmission companies.'"

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Iowa Utilities Lose Suits Against Municipal Plants

In a decision dictated from the bench Judge Charles A. Dewey of the United States District Court at Des Moines has refused the application of the Iowa Southern Utilities Company for an injunction against operation of the municipal electric light plant at Lenox, Iowa. Judge Dewey said he could find no ground for injunctive relief on the face of the contract for purchase of the electric plant. The court did not comment on constitutional questions raised. This was the first test case brought under the Iowa Simmer law, enabling municipalities to purchase electric plants on the installment plan.

An injunction sought by the Iowa Electric Light & Power Company to restrain the town of Grand Junction, Iowa, from erecting a municipal electric light plant under the Simmer law has been denied by Judge T. J. Klinker in District Court at Jefferson, Iowa. The court ruled that the contract between the town and Fairbanks-Morse Company did not impair the rights of the electric company and that the contract did not contemplate the levy of any money for taxes. This case also in-

volved the right of the town to oust the company from its streets. No effort had been made to secure renewal of a franchise that expired in 1919. The court held that expansion of the company's property since that time had been made at the company's own risk, and that the town was within its rights in denying the company further use of its streets, alleys and public grounds, and that four months from the date of the court's decision would be a reasonable time within which the company's distribution system should be removed.

In a recent case city officials of Campbell, Mo., and Fairbanks, Morse & Company were held in civil contempt of the United States District Court because the city continued to operate a municipal light and power plant after the court had issued an injunction against the project (ELECTRICAL WORLD, November 19, page 674).

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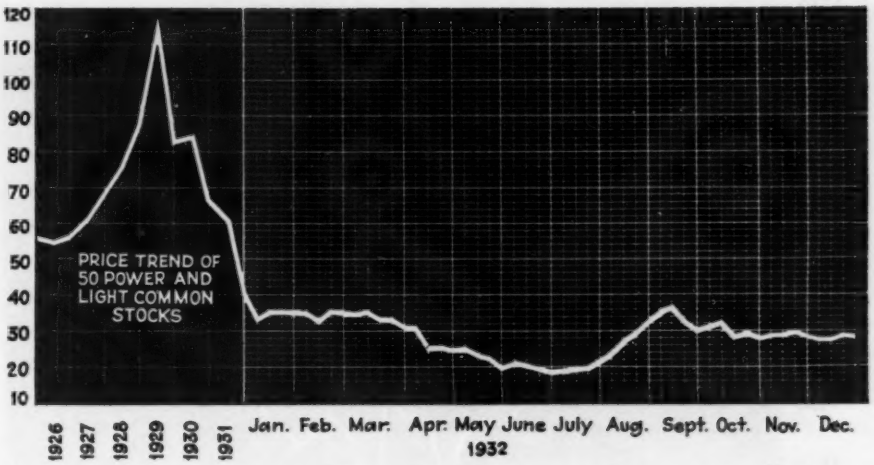
Committee Reports Obstacles to Beauharnois Financing

In a report recently submitted to bondholders the twelve members of the collateral trust bondholders' committee of the Beauharnois Power Corporation have stated that due to the existing financial conditions it has been impossible up to the present to finance permanently to the extent necessary to take care of the outstanding temporary loans and the additional construction requirements. Temporary loans, obtained from bankers through the co-operation of the Dominion government, amount to $21,000,000. New financing is required to take care of these loans as well as to provide $16,000,000 for deepening the power canal, control works in the St. Lawrence River and additional equipment.

"Until new securities can be disposed of," the report continues, "the earnings from present contracts must be used for interest on temporary loans, operating expenses and construction requirements. Hence resumption of cash interest payments on the bonds is not immediately in prospect. . . The committee is pleased to report that so far the construction cost has been well within the estimates and actual operation is proceeding satisfactorily. Having accomplished the completion of the first stage of the enterprise, the delivery of power on October 1, the committee is devoting practically its entire attention to permanent financing, upon which it will report to the bondholders at the earliest possible date."

The Beauharnois project, upon which $51,432,502 has been expended, is delivering 60,000 hp. to the Hydro-Electric Power Commission of Ontario and to the Montreal Light, Heat & Power Consolidated.

Utility Stocks Move Lower



Weakness in the general list was reflected to a certain extent in the light and power stocks, which lost some ground during the week. The Electrical World index stood at 28.3, as compared with 28.6 for the preceding week.

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Current Earning Reports of Electric Light and Power Companies

Operating Companies

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
Detroit Edison (Year ended November 30)					
Gross earnings	$44,469,028	$49,576,116	—10.4	71	65
Net earnings	13,061,425	17,320,071	—24.5	..	..
Net balance	6,933,806	11,376,143	—39.0	..	..
Duquesne Light (Year ended October 31)					
Gross earnings	25,704,257	28,168,646	— 8.5	43	42
Net earnings	14,695,223	16,356,111	—10.1	..	..
Net balance	10,931,078	13,428,227	—18.6	..	..
Louisville Gas & Electric (Year ended October 31)					
Gross earnings	10,021,232	10,860,385	— 7.7	56	53
Net earnings	4,382,668	5,136,021	—14.7	..	..
Net balance	1,734,519	2,389,887	—27.4	..	..
Northern States Power (Del.) (Year ended October 31)					
Gross earnings	32,751,065	33,968,559	— 3.6	59	57
Net earnings	13,351,468	14,599,054	— 8.6	..	..
Net balance	2,477,518	3,906,342	—36.6	..	..
Puget Sound Power & Light (Year ended October 31)					
Gross earnings	13,895,618	16,047,482	—13.3	61	62
Net earnings	5,493,968	6,022,353	— 8.8	..	..
Net balance	559,238	878,154	—36.4	..	..
Virginia Electric & Power (Year ended October 31)					
Gross earnings	15,711,874	17,067,603	— 7.8	65	66
Net earnings	5,520,440	5,778,852	— 4.8	..	..
Net balance	2,457,203	2,843,948	—13.5	..	..

Holding Companies

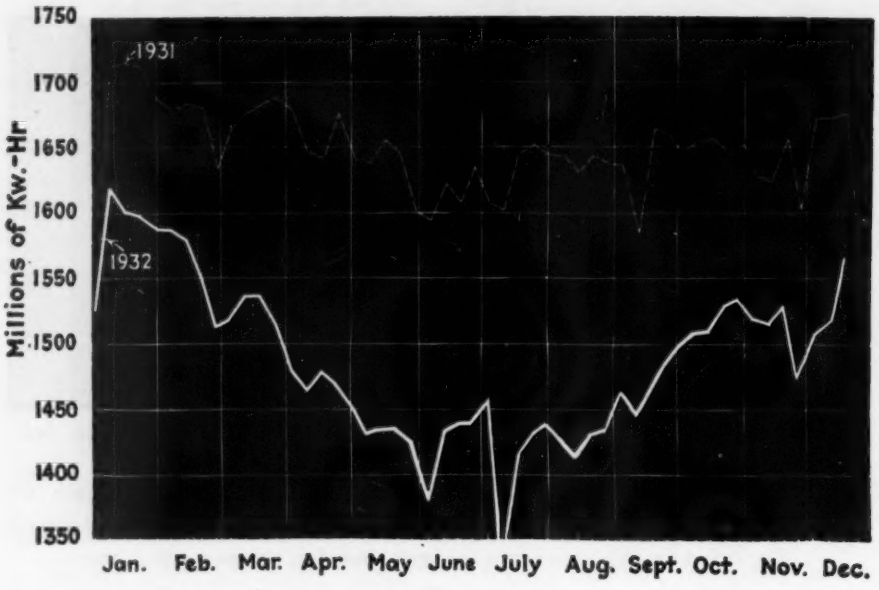
	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
American Power & Light and subsidiaries (Year ended September 30)					
Gross earnings	$78,242,394	$85,663,211	— 8.7	52	52
Income from subsidiaries	13,070,645	18,426,738	—29.1	..	..
Net balance*	1,349,575	7,150,331	—81.0	..	..
American Water Works & Electric and subsidiaries (Year ended October 31)					
Gross earnings	44,686,264	50,870,026	—12.0	56	58
Net balance	3,199,560	4,711,576	—32.1	..	..
Electric Power & Light Corp. and subsidiaries (Year ended September 30)					
Gross earnings	75,048,157	82,447,992	— 8.9	58	57
Income from subsidiaries	7,993,792	12,281,374	—34.9	..	..
Net balance†	1,033,158	5,205,577	—80.0	..	..
Engineers Public Service and subsidiaries (Year ended October 31)					
Gross earnings	47,247,400	52,919,795	—10.7	65	67
Net balance	2,230,742	3,950,203	—43.5	..	..
Philadelphia Company and subsidiaries (Year ended October 31)					
Gross earnings	50,232,398	58,940,987	—14.8	65	61
Net balance	5,785,788	11,795,765	—51.0	..	..

* Dividend on common stock not paid September 1, 1932.

† Balance available for second preferred and common stocks.

Gross earnings — (Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net earnings — Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc. Income from subsidiaries — Balance available from income of subsidiaries for holding company. Net balance — Balance available from income for common stock dividends.

Week's Output Closer to 1931



With an output of 1,563,384,000 kw.-hr. for the week ended December 17, central-station operations increased nearly 3 per cent compared with the preceding week. By this gain the gap between present production and that during the corresponding period of 1931 was materially diminished, being cut to 6.7 per cent, against 9.1 per cent the week before and 9.6 per cent two weeks earlier. The output is the largest for any week since the middle of last February and does not fall far short of conforming with the rising trend prevailing during August, September and October, interrupted in November.

The closest approach to 1931 occurred on the Atlantic seaboard, down only 3.6 per cent. In the Central industrial area and on the Pacific coast the disparity was the smallest since last winter, with a single exception in each case.

Weekly Output, Millions of Kw.-Hr.

Week Ended	1932	1931	1930	1929
December 17.....	1,563	1,676	1,770	1,860
December 10.....	1,519	1,672	1,748	1,841
December 3.....	1,510	1,671	1,747	1,806
November 26.....	1,475	1,600	1,672	1,718
November 19.....	1,532	1,655	1,722	1,818

Per Cent Change from 1931

	Week Ended		
Region	Dec. 17	Dec. 10	Dec. 3
Atlantic Seaboard.....	—3.7	— 7.4	— 7.7
New England alone..	—5.6	— 5.4	— 7.3
Central industrial.....	—8.2	—11.1	—12.3
Pacific Coast.....	—5.9	— 7.7	— 7.9
United States.....	—6.7	— 9.1	— 9.6

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Special Type of Rate for Pipe Line Pumping

Designed to give the customer as definitely as possible a maximum figure which his monthly bill will not normally exceed, the St. Joseph Railway, Light, Heat & Power Company is trying out a special type of rate for service to pipe line pumping stations. A feature of the rate that makes it particularly appealing to the customer is the fact that the monthly bill contains a credit for energy that might have been, but was not, used. Briefly, the rate embodies a $63 per kilowatt annual charge, payable in equal monthly installments, which assumes the consumption of 8,760 kw.-hr. per year for each kilowatt of demand; that is, 100 per cent annual load factor. But if the customer uses less than 8,760 kw.-hr. per year per kilowatt of demand he is credited with the non-used energy at the rate of 3.3 mills per kilowatt-hour, which is the energy increment cost. These use figures and conditions are reduced to a monthly basis so that billings and credits may be rendered at such intervals. The contract includes a fuel clause by which the energy component of the reservation charge of $63 and the credit item of 3.3 mills for non-used energy are modified 0.2 mill for each cent above or below stated mean costs per 1,000,000 B.t.u. in coal, gas or fuel oil.

At present the rate is experimental and for that reason the contract to the one customer now on it runs for only two years and contains a cancellation provision that may be exercised by the customer on 30 days' written notice with payment of a sum sufficient to cover the labor cost of extending and removing the service.

The rate is desirable from the utility standpoint as it gives practically the same return on plant investment at all times, regardless of load factor. From the customer's standpoint the rate is very similar to oil engine operating costs plus investment fixed charges.

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New Jersey Public Service Announces 1933 Rate Cut

True to the hope expressed several months ago by Vice-President Wakelee (ELECTRICAL WORLD, October 15, page 515), Public Service Electric & Gas Company announces a state-wide rate reduction to be made effective shortly which will aggregate a saving of $2,450,000 a year to electric consumers. Domestic consumers will realize a probable saving of $1,400,000.

As in the past, Public Service has once more passed the saving on to those using more than 20 kw.-hr. a month. Energy in the first block remains at 9 cents a kilowatt-hour. The next block of 20 has been reduced from 8 to 7 cents each and the next ten from 7 to 6 cents.

The Public Utility Commission has approved the reduction, although it sought a cut of $2,000,000 in domestic electric rates.

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Cook County Board Voices Utility Rate Protest

Action by the County Board of Cook County, Illinois, to secure lower utility rates has followed the presentation of a petition by one of its members with the request that the matter be referred to the Governor of the state. The petition contained references to the drop in commodity prices and to the failure of rates to parallel them. It charged the Illinois Commerce Commission with failing to protect the people from exorbitant rates, "as it should do according to law" with its power to "examine public utilities and keep informed as to their general condition."

Approving the petition, the board moved formally to begin a campaign for decreases in gas, electric, telephone and local transportation rates. The resolution of the board claims that Chicago utility rates are among the highest in the country and urges that they be reduced in proportion to the general decline of prices. The board appointed a subcommittee to press action on the parts of the state's attorney and the state commerce commission.

During the week G. Gale Gilbert, chairman of the Illinois Commerce Commission, announced that the engineering department of the commission is making a study of the electricity rate structure in Chicago and suburbs and upon completion of this survey the commission will determine whether or not it should take steps toward rate reductions.

Refrigerator Misnomer Alleged by Potters

Asserting that the description of covered metal as "porcelain enamel" by manufacturers of electric refrigerators and producers of domestic utensils is untrue, Dr. A. V. Bleininger, chairman of the research committee of the United States Potters Association, at its convention last week, urged that some action be taken by the organization. A special committee under his direction was appointed to investigate the matter. Dr. Bleininger previously urged the industry to undertake a campaign to point out "defects" in products being manufactured by General Electric, Westinghouse and DuPont from synthetic phenolic resin that are competitive to the pottery industry's goods.

In his attack on the manufacturers' use of "porcelain enamel" Dr. Bleininger pointed out that porcelain is made from a clay base. The domestic pottery industry is suffering from lack of a true definition for its products, he told the convention. That the description "earthenware" as now used is erroneous was his further contention in suggesting the adoption of "vitreous" or "semi-vitreous" ware as a better definition for tariff classification and general law purposes.

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New York Metal Prices

	Dec. 13, 1932 Cents per Pound	Dec. 20, 1932 Cents per Pound
Copper, electrolytic	5.00	5.00
Lead, Am. & S. R. price	3.00	3.00
Antimony	5.40	5.40
Nickel ingot	35.00	35.00
Zinc, spot	3.475	3.475
Tin, Straits	22.65	22.85
Aluminum, 99 per cent.	28.30	23.30

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R.F.C. Grants Seattle Loan of $1,621,000

After lengthy negotiations (ELECTRICAL WORLD, August 20, page 231, and September 24, page 391), the Reconstruction Finance Corporation has approved a loan of $1,621,000 to the Seattle Light Department to complete the City Light building and the Diablo power house, but has refused a one-million-dollar loan to extend the department's distribution inside the city. Superintendent J. D. Ross is reported to be extremely disappointed over the failure to secure the sum originally asked for to finish the Skagit plant and to build a transmission line from Diablo to Gorge Creek, to connect with the present transmission line. He declares that the loan allowed is only sufficient to complete the Diablo power house, for which machinery was purchased some time ago, but will leave the plant useless.

Mr. Ross, who is in Washington, D. C., is said to be negotiating with New York investment bankers to take a $1,800,000 City Light bond issue to provide money to retire warrants outstanding against the city light construction fund. It is the opinion of local authorities that the retirement of this debt would improve the city's chance of getting a more substantial loan from the R.F.C.

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Engineers' Day and Week for Chicago World's Fair

What promises to be one of the largest conferences of engineers ever held will convene in Chicago during the week of June 25-30 in connection with a Century of Progress Exposition. World's Fair officials have designated this period as "Engineering Week," and one day will be known as "Engineers' Day." Estimates of the probable attendance of engineers from all parts of the country, as well as from many European countries, place the figure at a minimum of 25,000 with a possibility of triple that number.

A general committee, known as the engineering societies committee of a Century of Progress Exposition, has already been established in Chicago under the chairmanship of Harry B. Gear. Organization work is now under way and a number of sub-committees have been appointed to function on the various phases of the coming event. The plan is for the various societies to hold individual or joint meetings of their own groups except for "Engineers' Day" when all groups will join in a giant conference. The outstanding engineers of this and other countries will appear on the program to report the newest developments in their respective fields. Coincident with the speaking program there will be held an exposition of power and engineering machinery and appliances in keeping with the size and importance of the gathering. Approval of participation has already been given by 19 engineering associations, either by their national headquarters, or through their Chicago chapters.

Major New Construction This Week

Southern California Edison Company has authorized fund of $3,982,922 for expansion program in 1933, including plant betterments, substations, transmission and distributing lines and other structures for operating service.

Until January 5, Fort Wayne, Ind., asks bids for construction of overhead and underground transmission line. Estimated cost $1,000,000.

Electric pumps, oil engine-generators, panelboards, instruments, etc., will be purchased for water works at Valdosta, Ga. Cost estimated at $100,000.

Machine drives, motors, transformer equipment, regulators, panelboards, conveyors, etc., will be installed in brewery of Ohio State Brewing Company, Columbus, Ohio. Estimated cost $500,000.

Bids asked by Bureau of Yards and Docks, Navy Department, Washington, D. C., for one 2,500-kw. turbo-alternator and accessories for Navy Yard, Brooklyn, N. Y. (Specification 7175).

Transformers, switchgear, switchboard instruments, power feeders, etc., will be installed in substation to be constructed early in 1933 by Municipal Light and Power Department, Pasadena, Calif. Cost about $200,000.

Machine drives, heavy-duty motors, electric hoists, electric traveling crane, etc., will soon be purchased for plant by Consolidated Steel Pipe & Tank Company, Phoenix, Ariz. Estimated cost $75,000.

Union Public Service Company, St. Paul, Minn., has authorized construction of new transmission line from Ghent, Minn., to Green Valley, Minn.

Paris Increases Use of Electricity

Due largely to the installation of electric lights on the streets of Paris in place of the traditional gas jets and to the more extensive use of electric advertising on the boulevards, consumption of electricity in that city has increased six-fold since the war. In 1914 there were only 93,000 subscribers for electricity for domestic use. In 1931 the total had increased to 616,000. For industrial purposes there were 90,000 subscribers in 1914, 600,000 in 1931.

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Delinquent Electrical Accounts

(National Electrical Credit Association)

Number of Accounts Reported

Division	November 1931	November 1932	Per Cent Inc. or Dec.	Eleven Months 1931	Eleven Months 1932	Per Cent Inc. or Dec
New York	202	219	+ 8.4	2,611	2,472	— 5.3
Middle and Southern Atlantic	99	76	—23.2	1,265	1,129	—10.8
New England	102	81	—20.5	1,022	1,073	+ 4.9
Central	474	265	—44.0	6,077	4,741	—22.0
Total	877	641	—26.9	10,975	9,415	—14.2

Total Amounts Reported

New York	$16,453	$19,815	+20.4	$328,282	$226,765	—30.9
Middle and Southern Atlantic	9,713	4,489	—53.8	156,346	96,739	—38.1
New England	7,329	4,513	—38.3	86,949	83,290	— 4.2
Central	39,675	18,829	—52.5	543,630	332,453	—38.8
Total	$73,170	$47,646	—34.9	$1,115,207	$739,247	—33.7

California Rate Order Enjoined

To prevent enforcement of a recent order of the California Railroad Commission reducing its rates, Pacific Lighting Company has filed an interlocutory injunction against discount on customers' bills. The reductions ordered involved an estimated annual saving of $500,000 to consumers. The company has filed a bond and will set up a reserve against the rates as collected pending adjudication of litigation.

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Hominy, Okla., Vote Contested

Charging illegalities in a recent election at which a municipal plant was voted, Oklahoma Utilities Company has instituted injunction proceedings against the city of Hominy, Okla., and several of its officials. A rate reduction which the power company made effective December 1 is reported to have dissipated the enthusiasm of many Hominy citizens for the proposed municipal plant.

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Kentucky Utility to Buy Energy

Receiver for the Kentucky Electric Development Company has decided that in the future that company will purchase all of its power for its several rural lines, instead of buying part of it and producing the remainder. Thus the Kentucky Utilities Company has secured a new wholesale customer.

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Radio Board Reduced to Twelve

At the regular monthly meeting of the board of directors of the Radio Corporation of America Bertram S. Cutler of New York City was made a director and the resignation as a director of Andrew W. Robertson, chairman of the board of the Westinghouse Electric & Manufacturing Company, was accepted. The by-laws of the corporation were amended so as to reduce the number of directors to a total of twelve (ELECTRICAL WORLD, December 10, page 770).

▼

Cambridge Rate Hearing Resumed

Upon resumption of the hearings before the Massachusetts Department of Public Utilities on petition of customers of the Cambridge Electric Light Company for reduction in rates, H. U. Greene, general manager, testified to a decrease in both electric consumption and revenue since the new rates were placed in force on August 1 last. Frank Coyne, representing the petitioners, told the commission that power rates in Cambridge are too low, asked for an increase and sought to have the benefits of such increase passed on to the residential user. The Cambridge company is opposing the customer petition on the contention that rates for electrical energy in its territory are the lowest of any company in Massachusetts (ELECTRICAL WORLD, October 22, page 552).

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Meter Storage Charge Proposed

A bill to compel gas and electric companies which assess customers a service charge to pay customers $1 a month for storage and protection of meters has been filed with the clerk of the Massachusetts Senate by Senator-elect Langone of Boston. The present service charges range from 50 cents to $1.

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It seems probable that 1933 will be a year characterized by sharp conflicts between politics and economics. Whatever may be the outcome for business, it seems likely that our national progress in economic education will be varied and rapid.

LEONARD P. AYRES
Vice-President
Cleveland Trust Company

[**Colonel Ayres, peering into the future with a reputation for unusual discernment and a high percentage of accuracy, sees exports, wages, cost of living, dividends and automobile production lower in 1933 than in 1932.**]

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Advertising Contest for Utilities

Another "Better Copy" contest will be conducted by the Public Utilities Advertising Association to cover advertising done during the year 1932, according to an announcement made by E. Frank Gardiner, president of the association. F. W. Crone of the New York Edison Company has been appointed chairman of the contest committee. Awards will be made at the annual meeting of the association next year in conjunction with the annual convention of the Advertising Federation of America.

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Manufacturers Unite to Light Fair

To assure an illumination spectacle that will attract the attention of the world, the General Electric Company and the Westinghouse Electric & Manufacturing Company will pool resources and laboratories for the lighting of the World's Fair Century of Progress Exposition to be held in Chicago. The two companies, in advising exposition officials of their willingness to co-operate, announced that the group of experts which will work out the illumination plan will be headed by W. D'Arcy Ryan of Schenectady. The agreement provides that the two companies shall participate in the installations, but that other companies may, at the discretion of the exposition, be permitted to furnish equipment.

New York Meter Hearing Continued

At a hearing last week before the New York Public Service Commission on proposed changes in electric meter rulings (ELECTRICAL WORLD, December 10, page 769), Milo R. Maltbie, chairman of the commission, contended it to be unfair to the public to allow companies to set fast meters and stated that the commission would govern the regulation of electricity meters within the same limits of accuracy as apply to gas and water meters. The hearing adjourned to January 18.

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Missouri Dam Permit Asked

Application for a major license to construct a dam and power unit in the Gasconade River near Arlington, Mo., has been made to the Federal Power Commission by the Gasconade River Power Company, pursuant to a preliminary permit issued in 1929.

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Standard G. & E. Cuts Dividend

Directors of Standard Gas & Electric Company have declared a quarterly dividend of 30 cents a share on the common stock, placing it on an annual basis of $1.20, as compared with the previous $2 basis. The regular quarterly dividend of $1.75 a share on the $7 preferred stock and $1.50 on the $6 preferred stock was declared.

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South Carolina Accepts Rate Offer

Orders approving, with certain modifications, reduced rate schedules of the Southern Public Utilities Company and Duke Power Company have been issued by South Carolina's Railroad Commission. Schedules recently submitted by the companies had been rejected (ELECTRICAL WORLD, December 10, 1932, page 776). The orders provide that the new schedules shall effect no increase in the rates for any consumer, shall eliminate a provision for cancellation on 90 days' notice and shall contain no clause providing for rate increases to meet possible additional burdens of federal and state taxes.

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Power Board Amends Security Order

Amending its recent authorization for a $7,500,000 general mortgage note issue by the Portland General Electric Company of Oregon (ELECTRICAL WORLD, December 3, 1932, page 739), the Federal Power Commission has announced that the notes to mature in 1935 shall serve as collateral for a one-year loan in lieu of sale to secure funds for the company's January 1, 1933, maturity.

Cost Allocations Asked in Seaway Treaty

Adoption of a reservation to the proposed St. Lawrence seaway treaty with Canada, to provide for equitable distribution of this country's share of the power and an understanding, if not concrete arrangements, for allocation of costs between the United States and the State of New York, was urged before the Senate committee on foreign relations last week by Frank P. Walsh, chairman of the Power Authority of the State of New York. New York always has claimed the rights to the power and has sought to protect itself at all times, Mr. Walsh said, but asserted that there were provisions in the proposed treaty that would have the effect of granting perpetual power privilege to three large corporate groups in the United States —the Aluminum Company of America, the General Electric Company and the DuPont interests. Mr. Walsh reiterated that the Power Authority of the State of New York was in no way seeking to disturb the efforts of the federal government to accomplish the arrangement of an international agreement between the United States and Canada, maintaining that he and his associates are in favor of the treaty.

James Grafton Rogers, Jr., Assistant Secretary of State, who participated in negotiation of the treaty, took a contrary view. He assured the committee he had no objection to the reservation suggested by Mr. Walsh as a protective measure and declared that for two years the State Department sought to reach an agreement with the New York authorities on the power phases of the St. Lawrence problem, but the effort broke up because New York insisted on an agreement and a policy. He said it was the State Department's view that Congress and not the executive branch of the government had jurisdiction in this matter.

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Secondary-Arrester Tie Improves Lightning Record

Further progress is reported in the protection of distribution transformers against lightning on the system of the Edison Electric Illuminating Company of Boston since the presentation of a paper by T. H. Haines and C. A. Corney on that topic before the 1932 winter convention of the American Institute of Electrical Engineers in New York. At a meeting of the Boston section of A.I.E.E. last week the authors related that the connection of lightning arrester ground wires to secondary grounded neutrals has been applied to 777 single-phase transformers since July 1. In only six cases did trouble occur among these units, all being blown fuses. Poor clearance was responsible for one outage and arcs across terminal boards for the others. Some companies have hesitated to adopt this practice on account of the possible added hazard to customers' wiring, but on the Boston system not a single case of trouble has arisen with customers' wiring or with meters during or after lightning storms. The data may not warrant final conclusions, but the trend has led to a decision to increase the number of interconnected locations considerably before the next lightning season.

Experience in the past six years has justified a decision to equip all distribution transformers in protected areas (exposed surburban districts) with lightning arresters. The cost is about $50 per single-phase transformer. About 4,400 out of a possible 5,600 units are now so equipped. A policy of eliminating transformers of small size and advanced age and high core loss has been adopted, and the company specifies a minimum primary clearance of 2 in. in new transformers. Several manufacturers are now offering transformers with discharge devices mounted both internally and externally to the transformer and so connected as to utilize the secondary neutral ground tie-in. Since 1926 the annual number of troubles per 100 protected transformers per 100 weather bureau lightning storm observations has been decreased from 17 to 5.7. There were 30.3 such troubles in 1927 on unprotected transformers and 7.2 in the current year.

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45-Kv. D. C. Generators Serve in Precipitation

Direct-current, commutating generator units have been developed by the English Electric Company, Ltd., which are capable of delivering about 0.15 amp. at 40 to 45 kv. Essentially each unit consists of a driving motor coupled to three generators connected in series. The frames of the generators are supported on porcelain insulators and each shaft is insulated from its neighbor by a suitable coupling.

This equipment, used in connection with improved precipitation processes, is said to offer the advantages of eliminating spark gaps, all control on low-voltage side and simple voltage regulation. An outstanding feature claimed for the system is its ability to withstand dead short circuit without flashover to ground.

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NO WALKING, NO PULLING, NO PUSHING, JUST FILING

Management Methods

With 27,000,000 cards to be filed and more coming along at the rate of 4,500,000 a year the Czechoslovakian Social Insurance Department sought an electrical solution for its problem. As a result government disability and old-age insurance records are now kept in some 2,720 drawers, each 11 ft. long ranged seventeen blocks high on two sides of this room in Prague. Electric motors hoist the work tables to the proper level and swing them sideways (carefully protected by automatic brakes). Foot pedals control the withdrawal position of the drawers. And the clerks file, and file, and file.

EDITORIALS

L.W.W.MORROW
Editor

Price for St. Lawrence power

ARGUMENTS have been had in Washington as to the allocation of costs to power for the contemplated St. Lawrence development. New York state is striving to get the power cost for the 1,000,000 hp. at around $75,000,000 and the government presents figures in the amount of at least $100,000,000. This difference appears small, but it may be decisive in determining the competitive position of St. Lawrence power.

The New York claim amounts to $100 per kilowatt. Assuming 40 per cent load factor, 7 per cent for interest and amortization and 0.02 mill for operating expenses, the total cost of power at the station would be 2.02 mills per kilowatt-hour. Assuming the government cost of $125 per kilowatt and the same data the total cost of power would be 2.52 mills per kilowatt-hour. Thus at the station there would be a difference of 30 or 40 per cent in the total cost of power to be used by the general public.

But the public is not at the station to use the power. Transmission total cost per 100 miles will be about 1.5 mills per kilowatt-hour, and this must be added if St. Lawrence power is to be used generally. Thus the two costs at a distance of 100 miles from the plant would be 3.52 mills per kilowatt-hour and 4.02 mills per kilowatt-hour. If this power were transmitted the 300 miles to New York the costs would be 6.02 mills and 6.52 mills.

These costs show the joker in St. Lawrence power if it is proposed to transmit it to any distance and the reason the New York state authorities are trying to get a minimum cost allocation to power. A modern fuel-burning station under ordinary favorable conditions can produce comparable amounts of power at the station for about 3.5 mills per kilowatt-hour. Thus fuel-burning stations are not competitive at the St. Lawrence plant, but they are competitive at a distance of 100 miles from the plant and they have the market to themselves at a distance of 300 miles from the plant. Thus without entering the realm of reliability and continuity of a transmission supply, present economics of power generation indicate the necessity of finding loads for St. Lawrence power at or near the plant. These loads are not now available and yet fixed charges will be active as soon as the plant is built. In the public interest, from the point of view of navigation and conservation, the St. Lawrence development may be advisable, but as a cold-blooded business proposition to generate power it is of very doubtful economic merit at this time.

Make it a Merry Christmas

THIS holiday season closes a year of stress. From an economic point of view we are glad to file its records, even though we are grateful for the relaxation the season brings to our tired mentalities. For we anticipate better times will come and the Christmas spirit inspires us to renewed efforts to make them come quickly.

But the balance sheet for 1932 shows many tangible spiritual gains to be placed in the assets of individuals and corporations. We have learned to understand each other better and have been forced to think about progress in terms of human relationships. The most marvelous thing about this depression has been the patience, understanding and forbearance exhibited by individuals and corporations and their practical applications of co-operation and aid to those in distress or less fortunate than themselves—this fellowship and team spirit has been an outstanding attitude

within the electrical industry. We have learned many lessons, but the most valuable one proves that the Christmas spirit should prevail throughout the year and arm us with an attitude and understanding that can aid us to gain victories over economic forces, smile under the blows of misfortune and extend a helping hand to fellow workers.

Bankruptcy prices or business building

A REMARKABLE feature of electrical manufacturing activities during the depression has been price stability. Business volume has dropped to about one-third 1929 levels and competition has become very keen, but as a whole electrical manufacturers have not tried the old fallacy of attempting to get business by cutting prices below costs. Deficits in net income for the majority of electrical manufacturers have been had for two years, however, and some weakness is evident in the price situation at this time because of the almost desperate conditions faced by some companies. They know that cutting prices below costs is disastrous and will not create a larger volume of business, but a specific order or bid may feed hungry workers and bring some money into the till to tide over what is hoped to be a temporary critical condition. It is business at any price to ward off immediate bankruptcy or worse.

What else can they do? One constructive point of view is to start over. Go back to the time when they started in business and use the methods and weapons that proved effective in building their business in those days to rebuild their business today. There always has been competition and no business has grown established except by constructively and vigorously fighting its way—no new enterprise would be insane enough to try to sell below costs. Times and conditions have changed, it is true, but there are more and better methods and weapons to fight with today than were available in the past. Too frequently apathy and a defense of what exists prevails to stimulate price cutting. Such companies have lost virility and lack intelligence. Business can be built all over again today and it should not be torn down by cutting prices below costs.

Technocracy shiver parties popular

POGO sticks, Eugénie hats and mahjong. All the rage one minute and then as suddenly an embarrassing memory. The newest craze is to hold shiver parties, in which each participant drops little chunks of Technocracy down the other fellow's spine. To democracy, plutocracy and even to idiosyncrasy there may be something to be conceded, but there is also idiocy to consider.

According to its parlor exponent Technocracy rests on one fundamental postulate, "that the phenomena involved in the functional operation of a social mechanism are metrical." Correspondingly, science is the "methodology of the determination of the most probable." Many a new cult starts off with rhetorical legerdemain no more alluring to the gullible. Analyzed for its essence, Technocracy is merely a restatement of what every one has sensed for the last two decades of the century and more since steam led to electrification of industry and the bugbear of technological unemployment. Modern wealth is energy only, social changes come from rate of energy use, the price system is obsolete—are these new or wonderful conceptions?

The broadsides of Technocracy are replete with the startling productivity parallels ferreted out by Thorstein Veblen, Stuart Chase, Harper Leech and others. You remember them. The Roman shoemaker who used to spend 5½ days making a pair of shoes; today modern shoe factories in the same time and per employee turn out all but the shine on the last one of 688 pairs of shoes. Note that nothing is said about the poor cobbler in Rome who knew no better than to spend 5½ days in tanning his own leather, sorting it, cutting it up, making it into shoes, drumming up markets, acting as combined advertiser, wholesaler, retailer, bookkeeper, manager, director and stockholder. In his ignorance he may have been a bit happier than we are at this moment, but would we have granted him that three years ago or will we do it again after we have succeeded in revamping our present disorganized set-up?

Technocracy at present is little more than a miasma, the high-faluting name for malaria, which in itself used to mean "what you imagine ails you." Nobody has malaria now. And it did not disappear from tabulations of health statistics because a remedy was found for it. It just ceased to be fashionable.

Changes in Financing Dictated by Experience

The suggestions made by the author might have sounded radical a few years ago, but they are receiving increased support from operating executives, and are therefore quite conservative expressions now. However, the author, who should be in an excellent position to advise quite impartially, fails to express any opinion regarding two major factors in finance:

1. Should both capital and book value be written down so they will be more in conformity with present values, to create a more favorable investment standing and provide a base on which rates can be offered that will meet the present trend toward private plants? If so, how should it be done?

2. Should surplus and cash reserves be established so investments can be gradually written off instead of being refunded perpetually, and if so, what should be the basis?

Doubtless either subject would require more discussion than the author could have included in the limited address which he presented before the Forum on Investment Banking offered in the graduate school of business administration, New York University, in co-operation with the New York section of the Investment Bankers' Association of America. But even if the complete answer cannot be given now some guideposts should be established by persons best informed to warn those who would persist in obsolete practices or adopt unsound new policies against wandering along paths that may lead eventually to disaster.

The complete address, of which this is only about one-third, included an excellent résumé of the history of financing and organization of utility companies, which explains why some things, of which we still have remnants, were done as they were and why they are so difficult to eradicate. This phase is not understood by the lay public, but is presumably well known by our readers, hence its omission.

By
HARRY M. ADDINSELL
President Chase Harris Forbes Corporation
New York

THE year 1932 should long be remembered as a period during which difficult financial tasks were successfully accomplished by utilities. The industry entered the year faced with the problem of refunding more than $377,000,000 of maturing obligations, exclusive of traction and rapid transit securities. During normal periods this amount of refunding would not have appeared difficult. But 1932 was not a normal year. Security market conditions grew steadily more unsatisfactory as time elapsed and the peak of maturities occurred during the summer months, which were the most unsettled market-wise of all. Nevertheless, we now find that only about 6 per cent of the total maturities remain unpaid.

This is a record of which the industry may well be proud. It signifies a high degree of co-operation between banks, investment bankers, the utility companies and the investing public. In some cases it was impossible to provide the necessary funds through security flotations. Here the banks stepped in with temporary assistance in the form of bank loans, which were subsequently liquidated by the sale of securities under the improved conditions obtaining later on in the year. In other cases the maturities were met by exchange offers of new securities, plus cash. Acceptance of these offers by the holders of the maturing securities was of material assistance in enabling a number of companies to forestall receivership.

By far the greater proportion of the securities, however, was paid at maturity, or very shortly thereafter, through the direct sale of securities to the public.

Signs of hope visible

Today we find signs of hope on the business horizon. The rate of bank and business failures has materially decreased from its high point earlier this year. Confidence has replaced fear. Funds are returning to the banks from hoarding. The drain on insurance companies through policy loans has slowed up. Banks and similar institutions find themselves with a plethora of cash or government obligations. The need for unusually high liquidity is gradually disappearing. Employment is picking up.

Dollars cannot long remain idle and already the effects of this situation are being demonstrated through higher prices for prime obligations of sound concerns.

The utility industry finds itself well prepared for the future. In general, operating properties have been kept in good condition; maintenance has not been deferred for better times; advantage has been taken in some measure of the technical and scientific developments of the past few years. While there exists an excess of generating capacity in many localities, this has not reached a point of danger. On the other hand, it indicates that the revenue from the first increase in sales should largely carry through to net earnings.

Large operating companies in good condition

Financially as well as physically the large operating companies are in good condition. Conservative dividend policies of the past have stood them in good stead. New construction expenditures were not necessary in the face of declining sales, and earnings formerly used for this purpose have been stored up as a back-log for future needs. Whereas funds are returning to the field of investment, in the immediate future new money will largely be needed by the utilities only for refunding purposes and for a limited amount of distribution-line construction. In 1931 more than 38 per cent of utility financing was devoted to refunding. For the first ten months of this year more than 46 per cent has gone for the same purpose.

During 1933 the amount of maturing issues is considerably less than last year. Excluding tractions, the

aggregate of maturities next year is only about $208,000,000, as compared with $377,000,000 last year. Of the $208,000,000 about $18,000,000 is now in default. It appears probable, therefore, that the amount of utility financing during 1933 will be considerably less than in 1932, although a return of business conditions to a more normal level during the year might well result in the sale of a larger amount of securities for providing new capital than would now be expected.

Major weak spots in holding companies removed

In the holding company field we find at present comparatively few serious weak spots left. There are some, and it may well be that some additional companies will be faced with the necessity of reorganization or elimination. By and large, however, most of the large and important holding companies have weathered the storm successfully.

The failure of certain of the so-called Insull holding companies in 1931 was a severe blow to the utility industry. Newspapers have seen fit to speak of the collapse of the Insull Empire as a whole. These reports are misleading. The Commonwealth Edison Company, People's Gas Light & Coke Company and the Public Service Company of Northern Illinois, the three largest and most important operating units in the Insull system, stand today as examples of well-operated organizations, physically and financially sound. These three companies handled this year an aggregate of $60,000,000 of maturities, which were paid in full in cash when due. Nearly all of the other related operating properties are today in sound financial condition.

The difficulties of Insull Utility Investments, Inc., Corporation Securities Company and Middle West Utilities Company did not result from a weakness of the operating companies. Expansion, which turned out to be excessive, and failure correctly to estimate the duration of the depression, coupled with a contest for control of properties, seem to have been the primary causes of the failure of these three companies.

The future will unquestionably have its difficulties, but these should be possible of solution, as have been those of the past. Experience indicates the advisability of making improvements in practice which should be constructive in that they will strengthen the credit standing of the utilities.

Some practices to discard

Today we hear from many sides great criticism of the holding company. To it are laid all forms of financial evil. The failure of certain large units has caused advocates of governmental ownership to class nearly all holding companies as devoid of real merit. This broad criticism I believe to be ill-founded and unjustified. Without this form of corporate organization the continued trend to lower rates and better services might have been materially retarded. Many examples abound today of holding companies which were, and are, strong, solvent and essential to the industry.

Some practices indulged in during the past must be eliminated in the future. One of these is the unwise use of operating company credit to assist the holding company. "Up-stream" advances of funds from subsidiary to parent should not occur. The operating company is in the business of supplying its customers with the best possible service at the lowest possible cost commensurate with a fair return to investors in its securities. A sound financial condition is essential to the proper functioning of this duty. Loans to weaker parents or the use of operating companies' credit to provide funds for other unrelated organizations cannot be condoned.

Similarly, the disposition of earnings available for dividends must be guided not by what the holding company requires, but by prudent business judgment as to what is best for the operating company. Fortunately, the capable and intelligent management of the leaders of the industry and of the investment banking fraternity recognize the unsoundness of this practice and steps have been and will be taken to cure it.

Logical grouping with diversity needed

A further desirable development is the gradual exchange of properties among the large systems so that geographic co-ordination of the units in each system may be more logical. A notable step in this direction was taken in 1930 by the North American Company when it sold to Pacific Gas & Electric Company its controlling interest in the San Joaquin Light & Power Corporation, the Great Western Power Company and Midland Counties Public Service Corporation. By this type of exchange a better integration of management and control can be accomplished.

It is not necessary that each holding company should control properties in only one state. The advantages of diversification should be retained, but scattered groups of properties throughout many states should be so rearranged as to fall into groups of sufficient size to permit economies of consolidated operation. I believe that the rearrangement of ownership in this manner will be an important and far-reaching future tendency.

Demand for more easily interpreted facts

Fuller provision of information to the public concerning the operations of the present large corporations is another development which should continue to take place. Already noticeable strides in this direction have been taken. In holding company groups detailed income statements and balance sheets should be rendered not only on a consolidated basis but also for the reporting corporation alone. Sufficient detail must be provided so that those who are interested may satisfy themselves as to the soundness of the situation in question and not be forced to take somebody's word for it. Furthermore, these statements should be so arranged as to make them capable of analysis by the average well-informed investor.

Much good could be accomplished by the adoption of a uniform classification of accounts for holding companies. There are, of course, some companies which act in unusual capacities, or have other peculiarities not common to the group as a whole. It would perhaps be impossible for these companies to adapt their accounts to a standardized classification. The majority of holding companies in the industry, however, could do so to advantage. A step in this direction would make more readily possible comparisons and analyses of the securities of these companies. It would be sound business and would tend to increase confidence, no matter how great it now may be, if all holding companies had their accounts and those of their subsidiaries audited annually

by certified public accountants and included statements so verified in their annual reports.

Further refinement in the nomenclature of securities is necessary. For example, mortgage bonds must not be called "first mortgage bonds" unless they are such. Unsecured debentures should not be called "bonds." The distinction between voting and non-voting common stocks must be clearly drawn. These measures and others of similar nature will, if consistently adopted, be of benefit to the issuing corporations.

Operating securities best for customers

The desirability of the sale of equity securities of holding companies to customers of the operating companies is open to serious question. Prior to the fall of 1929 this type of preferred and common stock was sold, in some cases, to the uninformed customer of the local operating company. Local company employees became high-pressure salesmen for holding companies' securities. Purchasers may have believed that the securities which they were buying represented in substance, if not in name, the earning power of the local company. Yet the fluctuations of business conditions and earning power are more pronounced in effect on holding company securities than on those of the operating subsidiaries. Unfortunate financial losses to these customers and impaired public relations of the utilities have on occasion been the result.

The customers of the operating company are generally not in a position to take the ordinary business risks incident to the purchase of holding company junior securities. A primary object of customer-ownership sales should be to insure safety of investment for the customer.

Accordingly, I believe the sale of securities to customers should be confined to securities of the operating companies and, possibly in some special cases, to senior securities of the holding company. This will give to the customers a greater degree of safety in addition to obtaining for the utilities the desired financial interest on the part of the customers, which in turn may be developed into better public relations.

Weakness in debenture pledges

There are numerous technical details concerned with corporate financing which we recognize are capable of improvement. Of these I will mention only one. This is the need for a further strengthening of the negative pledge clause contained in most unsecured debenture agreements. This is particularly an essential refinement in reference to holding and investment company debentures. The common provision is that the assets of the debtor company must not be pledged, except for periods of less than one year, without equally securing the debentures. This provision, as generally used in the past, has developed an unsuspected weakness. Pledges as security for bank loans nearly always are intended to be for periods of less than a year. Unforeseen events sometimes make these short-term loans assume the nature of semi-permanent borrowings.

Some sort of definite restriction must be placed on the amount of borrowing which may be accomplished in this fashion. If this is not done, the time may well arrive when a continued decline in the value of the pledged assets will result in the continued pledging of additional assets until the supposed security behind the debentures had been entirely subjected to the pledge. A further decline would then wipe out the debenture holders without giving them any possibility of recouping their losses. It is alleged that this is exactly what took place in the Insull situation, with a fatal effect on debentures which originally had behind them a full sufficiency of assets.

This leads to the conclusion that such debentures as may be issued in the future must have either strong and effective negative pledge clauses or else be protected by the actual pledge of collateral.

Complicated structures objectionable

A final suggestion—which is not new or original but which bears repetition—is that the holding company systems should undertake a more general simplification of corporate structures and capital securities. A corporate set-up which may readily be analyzed makes for a better appreciation of the value of securities outstanding thereunder. Capital issues which are not complex are as a rule preferred by investors to those which are involved. Important steps in these directions are being made by many companies. They should be continued.

Prospects for future financing

For the near future I expect that new funds for the utilities will be raised primarily through the issuance of mortgage bonds. As we gradually emerge from the present period of reduced earnings, and generally inactive business, equity securities will again be utilized as an important means of providing capital. For those investors who seek possibilities of appreciation, and who can take the business risks coincident thereto, the common stocks of holding companies will offer an attractive medium.

Improvement in earnings, the regaining of more normal security markets and a continued return of confidence should result in the common stocks of sound operating companies being regarded, more than ever before, as an investment medium. The average individual investor will continue to recognize as sound investments the mortgage bonds of operating companies and the debentures of conservatively capitalized holding companies, backed by the ownership of equity securities having tangible value and proved earning power.

I look to continued use of the holding company as a means for economic and efficient financing and management of operating properties. The operations of these companies will be carried on in a sounder, more conservative fashion.

In conclusion, I look forward to a bright future for the electric and gas industries. This I feel to be so in spite of the investigations and counter investigations, the political recriminations and other forms of attack from which the utilities are suffering as did the railroads some twenty to twenty-five years ago. Although electric and gas services now represent one of the smallest items of cost included in living expenses, rates will be further reduced as a result of technical improvement in the methods of production and distribution. Greater consumption will follow lower rates and the discovery of new uses for these services. More conservative and constructive financial policies will assist in reducing the cost of capital. The final result will be a steadily widening recognition of the investment merit of public utility securities.

Industrial Activity Continues to Increase

NOVEMBER reports of energy consumption for manufacturing indicate that the rise noted in September and October continued. The low point was reached in August. Compared with this, November operations advanced nearly 20 per cent. Since the downward movement began, early in 1929, there have been a number of occasions when it was interrupted by a temporary rise, but this is the first rise that has persisted through three consecutive months.

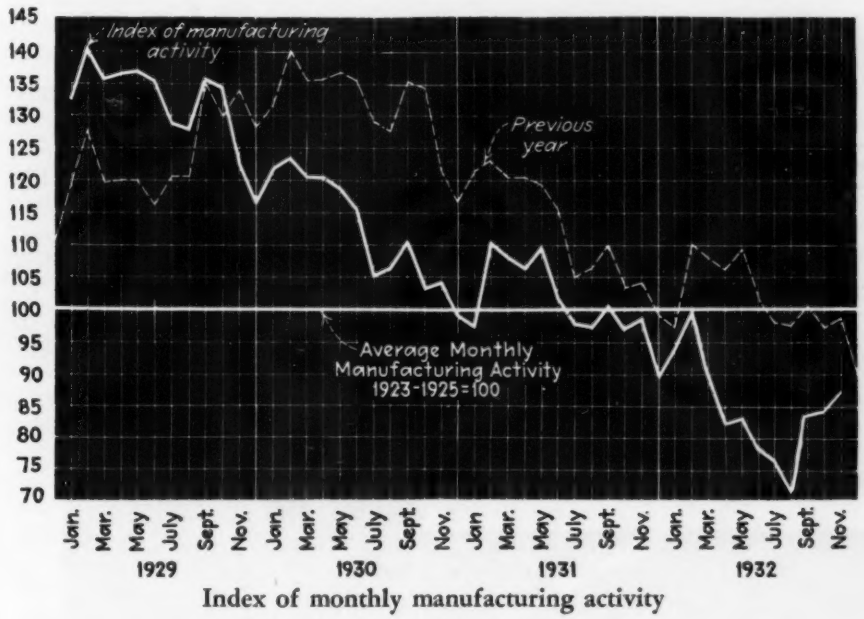
The figures here presented have been adjusted to take account of differences in the number of working days due to the calendar and to holidays. In quite a number of instances the November figures, even without such adjustments, were actually higher than those for October.

Meanwhile the October gain over September—in itself unusual, as was pointed out last month—proves to have been rather larger than it at first appeared. Inclusion of belated returns brings the increase above 1 per cent, instead of 0.5 per cent as was previously announced.

The various geographical divisions did not share equally in the November advance, their averages necessarily responding to the movements of dominant regional industries. Only one region, New England, registered any noteworthy decline from October, but there remains a gain of 24 per cent over August. In the Middle Atlantic, North-central and Western states the averages rose.

In line with reports of increased employment in the automobile industry, the rate of activity measured by energy consumption increased 25 per cent. So great a rise from October to November has never before been recorded in the present series of energy statistics, going back to 1923. In every year except 1931 there was a pronounced decrease. Against this unusual movement the present extraordinarily low level of the industry must be taken into account. The favorable effect of the rise was most pronounced in the North Central states.

Iron and steel has for a number of months been ad-

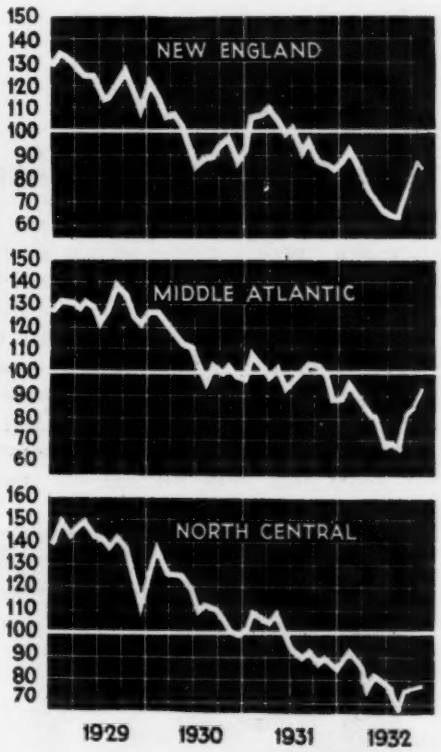

Index of manufacturing activity
Previous year
Average Monthly Manufacturing Activity 1923-1925=100
145 140 135 130 125 120 115 110 105 100 95 90 85 80 75 70
Jan. Mar. May July Sept. Nov. Jan. Mar. May July Sept. Nov. Jan Mar. May July Sept. Nov. Jan. Mar. May July Sept. Nov.
1929 1930 1931 1932

Index of monthly manufacturing activity

Base: Average month 1923-1925 = 100

(Corrected for number of working days, but not for seasonal variation.)

These data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,800 large manufacturing plants in various industries and scattered throughout the country.



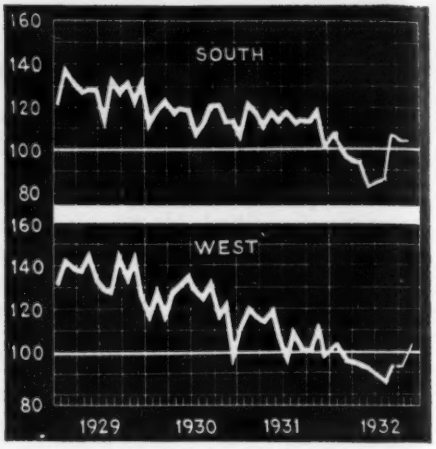
Industrial Group	United States Nov., 1932	United States Oct., 1932	United States Sept., 1932	United States Nov., 1931	New England Nov., 1932	New England Oct., 1932	New England Sept., 1932	New England Nov., 1931	Middle Atlantic Nov., 1932	Middle Atlantic Oct., 1932	Middle Atlantic Sept., 1932	Middle Atlantic Nov., 1931	North Central Nov., 1932	North Central Oct., 1932	North Central Sept., 1932	North Central Nov., 1931
All Industry	**87.6**	**85.1***	**84.0**	**99.7**	**84.0**	**90.2***	**80.5**	**90.1**	**91.5**	**86.8***	**83.8**	**96.7**	**78.5**	**75.4***	**74.8**	**91.5**
Automobile (including parts and accessories)	47.3	37.7*	36.5	67.3	.....	.....	.....	.....	62.6	47.2*	40.2	83.5	46.5	38.6*	36.5	65.3
Chemical products (including oil refining)	132.3	129.0*	126.8	145.0	140.5	153.6*	136.3*	166.7	139.5	131.8	132.1	153.0	118.7	110.2*	107.8	118.9
Food products	121.3	118.0*	129.5	139.5	.....	.....	.....	.....	130.0	110.0	114.9	116.6	116.9	116.8*	129.0	129.1
Iron and steel	57.7	54.8*	50.6	75.4	98.0	100.3	91.3	103.0	46.8	41.3	40.0	64.5	61.7	59.5*	53.2	75.6
Metal working	55.8	53.0*	51.8	77.5	81.2	79.3*	68.7	97.0	53.3	51.6*	50.2	68.8	51.5	45.6	46.1	75.6
Metals group	56.5	53.8*	51.3	76.0	85.9	85.3*	75.0	98.6	50.7	47.2*	45.8	67.0	55.3	50.9*	48.6	75.6
Leather products	95.4	93.7*	93.7	77.0	80.7	95.5*	94.2*	54.1	120.3	103.1	108.2	98.0	84.8	79.6*	76.7	73.0
Forest products	95.5	88.5*	80.6	83.1	43.2	44.0*	42.0	49.2	56.2	53.6*	45.4	82.2	84.3	83.5*	85.6	68.5
Paper and pulp	112.8	111.3	107.4	122.9	107.5	115.3*	110.5	149.8	66.7	68.1*	68.7	77.2	115.8	112.2	103.7	109.6*
Rubber	93.0	86.5*	87.7	99.1	103.8	105.4	96.8	103.0	.....	.....	.....	.....	87.6	77.0	83.3	101.7
Shipbuilding	84.0	72.3*	84.0	95.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Stone, clay and glass	82.8	84.3*	90.3	115.0	.....	.....	.....	.....	63.3	66.7	70.6	83.7	101.7	109.3*	109.3	128.1
Textiles	92.7	94.8*	86.7	93.4	68.3	78.3*	67.5	64.0	124.0	122.8*	111.0	113.5	124.5	117.5*	104.2	124.3

*Revision.

Indexes of Industrial Activity in South and West

	South					West				
Industrial Groups	Nov., 1932	Oct., 1932	Sept., 1932	Aug., 1932	Nov., 1931	Nov., 1932	Oct., 1932	Sept., 1932	Aug., 1932	Nov., 1931
All Industry	**103.5**	**103.8**	**108.5**	**87.9**	**119.3**	**102.3**	**96.8***	**96.0**	**89.4**	**110.9**
Chemicals	142.9	146.8	144.0	120.8	160.0	84.5	86.0*	84.2	85.3	98.9
Food	138.7	151.0	171.6	153.7	174.8	110.5	112.0*	120.0	113.6	149.0
Iron and steel	71.7	85.7	107.1	79.0	120.3	.....	.....	.....	.....	.....
Metal working	51.7	64.3	61.2	62.8	79.0	.....	.....	.....	.....	.....
Metals group	62.3	76.2	87.0	72.0	102.1	46.7	42.8*	38.4	35.6	46.9
Forest products	51.4	50.5	44.1	33.7	60.7	145.7	132.8	121.2	104.8	135.5
Paper and pulp	157.5	145.0	142.2	114.1	124.4	134.0	139.5	135.4	126.7	133.0*
Rubber products	78.8	78.6	86.8	88.9	79.5	62.5	75.8	84.5	92.8	68.1
Shipbuilding	.....	.....	.....	.....	.....	113.0	88.5	108.0	96.5	98.1
Stone, clay and glass	143.4	113.8	143.2	103.2	199.0	74.0	71.3*	81.3	82.0	112.3
Textiles	116.0	107.8	105.3	81.2	106.1	.....	.....	.....	.....	.....

*Revision



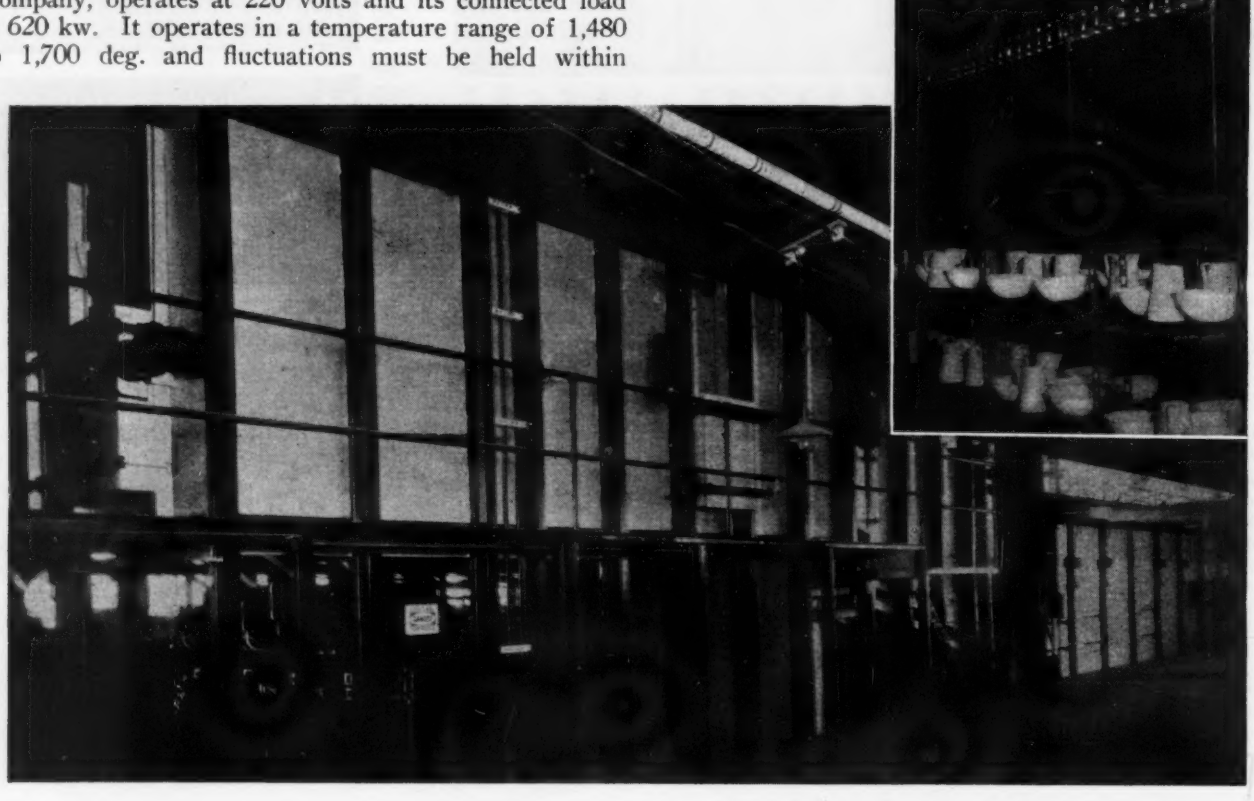
vancing everywhere except in the South, where the index shows the effect of one large company whose reports indicate a pronounced peak in September and a subsequent decrease. Operations of other companies were much more steady.

In metal-working plants the index for the country as a whole is now up 24 per cent from August. In New England the rise was greater but the minimum last summer was so low that the present level is still 16 per cent under 1931. Forest products also advanced, especially in the West, where this industry accounts in part for the higher regional average. In contrast, the textile and leather industries, after recent advances, remained nearly stationary at last year's level or higher. In New England textiles receded, approximately balancing gains elsewhere.

▼ ▼ ▼

Photo-cell Control and Electric Heat for Enameling

Cleanliness, automatic control and precision of operation are the advantages which have resulted from the use of an electric vitreous enameling furnace now in successful operation at the plant of the National Enameling & Stamping Company, Granite City, Ill., manufacturer of enameled kitchen and household ware. The furnace, which was installed by the General Electric Company, operates at 220 volts and its connected load is 620 kw. It operates in a temperature range of 1,480 to 1,700 deg. and fluctuations must be held within 10 deg. Metalware is dipped into wet enameling mixture, put through a drier, then placed upon a conveyor for addition of color decorations by hand. Congestion on this conveyor is avoided by a photo-electric cell which automatically stops the conveyor when any article passes a given point in the line. From this conveyor the metalware is loaded on a moving line of hanging shelves, which move through the furnace at a speed of 12 ft. per minute. Use of electricity for heating preserves the brickwork of the furnace, whereas other fuels seriously damaged the walls after six months' operation.



Short-Circuit Tests Prove Primary Network

By R. J. SALSBURY* and H. S. MOORE†

THE Duquesne Light Company has for a number of years followed the practice of checking the protective features of all new installations by applying actual faults to the system. Consequently the favorable operating experience reported in ELECTRICAL WORLD, November 5, 1932, page 625, for the primary network was not viewed as exhaustive proof of satisfaction with it. Therefore it was subjected to staged short-circuit tests.

The ability of the standard network relay to clear faults involving short arc or solid copper contact was questioned and during preliminary ground fault tests it was found that satisfactory operation could not be obtained under these conditions. Several methods of correction were considered and it was finally decided to install potential phase-shifting transformers of the type commonly used in reactive component metering. Thus, the potential for each element of the network relay is obtained partly from the other phases and maintained at a value which will properly operate the relay even on a solid copper fault. The phase relation of the voltage and current on each element of the relay during normal conditions has not been changed by this scheme, so that for operation on the exciting current of the transformer the equivalent of the standard in-phase connection is secured. Other methods could probably be used to accomplish the same result and it would be desirable to avoid using auxiliary equipment with the relay.

The first tests made on the primary network indicated that satisfactory selective operation would be obtained from the inverse-time overcurrent protection on the network "tie mains" and that the unbalance produced by the induction regulators included by the 4-kv. bus differential protection was below the minimum operating current of the differential relays. It was found, however, that faults in certain locations within the transformer switching units would not clear in a satisfactory manner and the following detailed tests were made to investigate this condition and check the changes made for its correction:

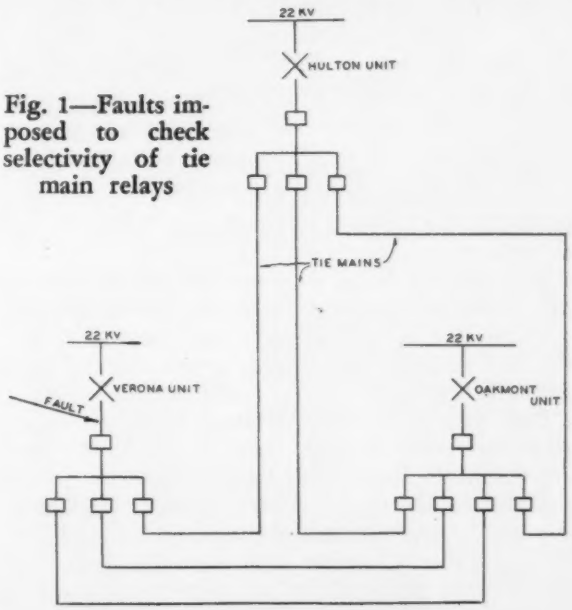


Fig. 1—Faults imposed to check selectivity of tie main relays

The original calculations on the selection of the inverse-time protection on the network "tie mains" covered all of the probable operating conditions and indicated that selection between the various breakers could readily be obtained, and although complete tests on the inverse-time protection were not considered practical, it was decided to apply faults at one location and check the calculated values of fault current distribution. Staged tests were made on April 14, 1931, at a time when only two of the units were in service. Line-to-neutral and line-to-line solid copper faults were applied to a spare network "tie main" breaker at the Oakmont unit and the distribution of fault current measured for each type of fault. Test results are given in Table I and show that ample time selection was obtained between the network "tie main" breakers at Hulton and the clearing of the fault at Oakmont. The calculated values of fault current for the test conditions were found to check very closely with the actual values, so that it is believed that under normal conditions the correct operation of the inverse-time protection is assured for all fault locations.

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Table I—Tests of Relay Selection in Feeder Tie Mains

Network Set-Up	Fault Location	Oakmont Unit Tie Main 4282 Total Current	Oakmont Unit Tie Main 4282 *Relay Operating Time, Seconds	Hulton Unit Tie Main 4281 Total Current	Hulton Unit Tie Main 4281 *Relay Operating Time, Seconds	Hulton Unit Tie Main 4284 Total Current	Hulton Unit Tie Main 4284 *Relay Operating Time, Seconds
Oakmont transformer open, Hulton only in service Fig. 2(A)	Oakmont 4282 Phase — ground	1,050	2.8	450	+10	480	+10
Oakmont transformer open, Hulton only in service Fig. 2(A)	Oakmont 4282 Phase — phase	1,225	2.1	640	8.0	570	9.0
Two units in service Fig. 2(B)	Oakmont 4282 Phase — ground	2,375	0.8	415	+10	390	+10
Two units in service Fig. 2(B)	Oakmont 4282 Phase — phase	2,550	0.75	520	+10	470	+10

*A comparison of these three times gives the selection on the relaying.

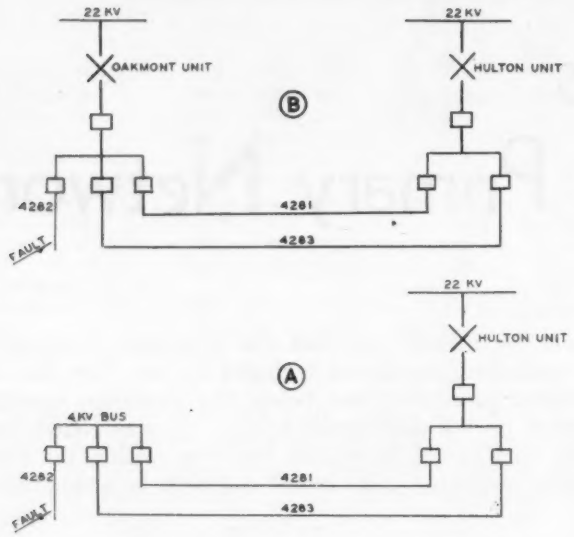

Fig. 2—Fault imposed to check operation of network relay

After the third unit was installed another series of tests was conducted during July, 1931, to check the performance of the network relays during various operating conditions.

Line-to-ground faults were applied between the transformer bank and the 4-kv. bank breaker at the Verona unit as in Fig. 2. The fault was supplied from the 22-kv. bus at Verona and also back from the primary network through the Oakmont and Hulton units. The first fault was tried with the usual in-phase connection on the network relay at the Verona unit. It was observed that the tripping contacts of the relay at Verona opened during the fault, which was incorrect, since this relay should have operated and opened the transformer breaker. Table II gives the currents and voltages obtained on all three phases of the transformer breaker and represents the current flowing from the primary network to the fault.

It will be noted that the voltage of the faulted phase (B) is reduced to 5.1 volts, so that this element of the relay gives very little torque. Fault current is obtained in the two other phases, and although these currents are not large, as compared with the currents in the faulted phase, they are more effective in producing torque on the network relay, since the phase voltages are maintained at normal value. The resultant torque is in the reversed direction and causes improper operation of the network relay. This condition makes it undesirable to use the standard in-phase connections if the network relay is used to provide a directional indication for the instantaneous current relays.

Arcing faults created a problem

Under normal service conditions a fault would probably be accompanied by arcing so that the additional drop in potential across the arc would be available for operating the network relay. It was desired to determine approximately the minimum length of arc on which satisfactory operation could be secured with the usual in-phase connection of the network relay. The arc was started between two 1x$\frac{1}{4}$-in. copper straps clamped around a fire brick using No. 16 copper wire as a fuse.

Table II gives the voltage and current obtained with a 1-in. arc which increased the voltage drop on the faulted phase to about 9.0 volts. On this test the network relay would not operate with a standard in-phase connection. The arc length was then increased to 4$\frac{3}{4}$ in. and another test made at this value. The voltage drop across the fault increased to about 20.9 volts and it was observed that the network relay operated correctly with the standard connection.

It should be noted that the resistance drop which was obtained in the tests through the grounding lead would not be present in actual faults, and the network relay might require a somewhat longer arc to insure reliable operation than was found necessary during the tests. However, it appeared from the torque which the relay developed in the case of the 4$\frac{3}{4}$-in. arc that satisfactory operation could be obtained with the standard in-phase connection on faults having an arc length of about 4 in. or greater. Since there is a possibility of solid faults or arcs under 4 in. it was found desirable to obtain some means of obtaining correct relay operation under all conditions.

To overcome the objections of the above schemes it was decided to supply the potential for the network relay from a potential phase-shifting transformer (Fig. 3). Under normal operating conditions the connections give an equivalent to the standard in-phase connection, but during a solid line-to-ground fault the potential is maintained on all three phases of the network relay.

After the phase-shifting transformer was installed a solid fault was applied in the same location as before. During the fault only about 5.1 volts (secondary) were obtained on the faulted phase due to the drop in the test load. However, the network relay operated correctly and tripped the transformer breaker.

The network relay was connected with a 60-deg. lead-

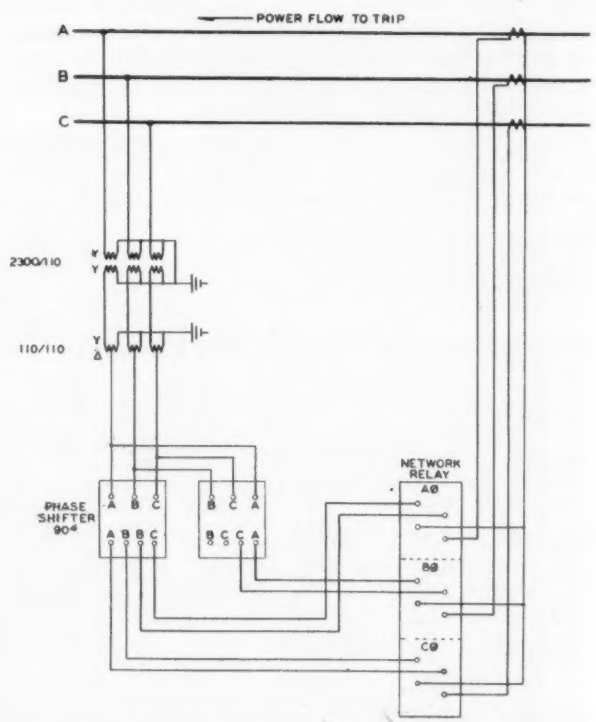

Fig. 3—Network relay potentials taken through phase shifter

Table II—Results of Tests Made to Determine Type of Connection to Be Made on Potential Elements of Network Relay

Type of Connection	Fault Location	Type of Fault	Fault Current from Network A	B	C	Current in Network Relay A	B	C	Voltage on Network Relay A	B	C	Operation of Network Relay
Standard in-phase.....	Verona unit trans. sec. B phase to ground....	Solid	287	4,100	445	5.7	82	8.9	116	5.1	116	Failed to operate (incorrect)
		1 -in. arc	287	4,100	445	5.7	82	8.9	116	9.0	116	
		1½-in. arc	287	3,600	410	5.7	72	8.2	116	20.9	116	Operated (correct)
In-phase with phase shifter..	Verona unit trans. sec. B phase to ground....	Solid	287	4,100	445	5.7	82	8.9	103	41.5	103	Operated (correct)
60-deg. lead connection.....	No fault test applied....	.....	...	.....	...	...	..	...	...	....	...	Failed to operate properly on magnetizing current

ing potential. Although with this scheme satisfactory clearing of the fault would probably be obtained, two undesirable features have been found:

1. The network relay will operate on circulating current between the units.

2. If the section of high-tension line supplying the network transformer draws enough charging current the polarity of the network relay will reverse and fail to open the bank breaker when the high-tension line is energized from the network transformer.

The induction regulators provide for 5 per cent regulation of the transformer low-tension voltage and during these tests the unbalanced current in the 4-kv. bus differential relay which overlaps the regulators was recorded for the maximum raise and lower positions and in the neutral position. The fault was located on the network side of one of the main breakers and was a solid copper tie to the grounding system. This gave the greatest obtainable unbalance. The oscillograph was used to record the currents in all three phases of the differential relays and the total fault current. A maximum of 2.2 amp. was recorded in the differential relay on the faulted phase, which is only about half of the minimum operating current. It is apparent that no trouble will be experienced from this condition.

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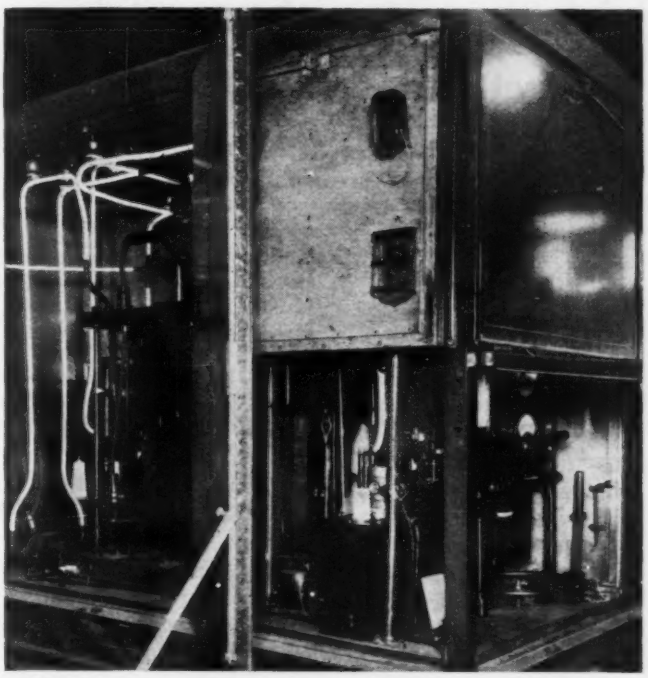
Faults Not Healed by New Test for Location

For locating faults in power cables the Consolidated Gas, Electric Light & Power Company of Baltimore has developed a new method which avoids healing the fault during the test. A common and troublesome experience in fault location is the frequent partial or total loss of faults due to healing caused by the flowing of oil or compound over the fault. This destroys the indication on which the location of the fault depends, when low-voltage measuring or signaling current is employed, necessitating a repetition of tests with high voltage, great inconvenience and loss of time in manipulating large apparatus, cables and system connections.

Through its current-limiting feature the apparatus also eliminates the danger of damage to adjacent cables and the strain on connected apparatus arising from the heavy currents pertaining to some of the older methods of fault burning. An added advantage in the new method is the elimination of the costly use of large generator units.

The apparatus is assembled in portable form on a trailer. It consists of a rotating contactor which makes and breaks a short circuit across the secondary of a constant-current transformer, which supplies the current through the fault for signaling as well as burning. In some of the older methods there is need for two sets of apparatus, a high-voltage outfit for burning and low-voltage equipment for signaling or measuring. The use of one transformer for both burning and signaling is new in this apparatus.

Included in the portable test outfit are the necessary control apparatus, indicating instruments and flexible leads, so that it may be energized from pole lines and underground feeders as well as from station buses.



Signaling and burning current from one apparatus

Healing of fault avoided because high or low voltage is supplied automatically, depending upon the resistance of the fault at each stage of the test.

The primary side of the fault locator is connected to a 2,500-volt a.c. source of power. The secondary, or variable-voltage side, is connected to the conductors of the cable at fault. A ground connection common to both sides is also made. With the rotary contactor open and inactive, the constant-current transformer is energized by closing in the primary oil switch. The voltage thus impressed on the cable produces a current flow through the fault, which burns or carbonizes the fault-insulating material and reduces its resistance. Excess current is avoided by the automatic regulating characteristics of the transformer. The burning action is continued until the fault resistance is low (15 ohms or less). The value of this resistance is gaged by ammeter and voltmeter readings on the apparatus.

The rotary contactor is then operated. This short-

circuits the secondary of the transformer about 200 times per minute, resulting in alternate flow of current, either out through the cable to the fault or through the contactor. This pulsating flow of current in the cable may be detected by special exploring coils connected to head-phones, producing a ticking sound. This signal is listened for on the faulty cable in manholes. The presence of the signal in one manhole and its absence at the next indicates that the cable fault is between the manholes. Frequently the fault burning produces smoke, which can be seen and serves as a check on the signal.

After the success of the original experimental work a permanent outfit was constructed and has had successful service. Its field of work has included 4-kv., 13-kv. and 26-kv. cables and submarine cables.

▼

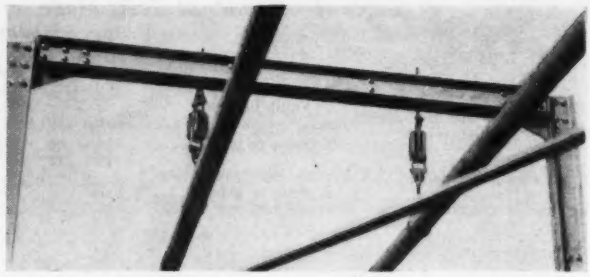
Sodium in Pipes Successful as Electrical Conductor

By R. H. BOUNDY
Physical Research Laboratory,
Dow Chemical Company, Midland, Mich.

Due to the daring of the late Dr. H. H. Dow of the Dow Chemical Company metallic sodium has been given an economic and physical trial as an electrical conductor on a sizable scale. The conclusion, after a year and a half of performance, is that iron pipe filled with sodium would be no more expensive or less effective than copper if it could be bought for practically the cost of the pipe plus the cost of the sodium. The applicability is restricted primarily to permanent installations involving high currents at the relatively low voltages used in the electro-chemical industry.

Sodium has a specific resistance three times as high as copper, but a specific gravity one-ninth as much. It takes, therefore, only a third as much sodium by weight to equal the conductivity of copper. Ignoring costs of development and differences in installation methods, sodium should have a chance if it did not cost more than three times as much per pound as copper. With this as a background and some experimentation on joints, filling, permanence of resistance and ability to survive overloads it was decided to build a line 840 ft. long to carry a maximum of 4,000 amp. A 4-in. standard pipe gives adequate cross-section of sodium. The costs and performance could properly be compared with four circuits of 1,000,000-circ.mil copper of practically the same length in parallel with it and functioning under approximately the same loading.

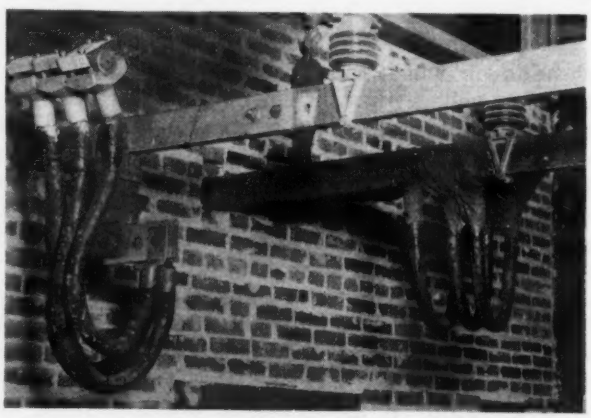
In this pioneering installation it was first necessary to devise the technique for filling the pipes with melted sodium, guarding against fire hazard and protecting the exposed ends against oxidation until they could be assembled. In assembling, each coupling was fitted with a 1-in. pipe plug for venting and overflow during the final processing at the joints. After pulling up the couplings the joint was heated to about 150 deg. C. to fuse the abutting ends of sodium together. Sodium oxide floats to the top and therefore does not change the resistance of the joint. The pipe plug is replaced as soon as the joint cools. A properly made joint shows the same resistance as a solidly filled length of pipe. After the line was completely installed it was found that the conductivity was only 7 per cent less than the theoretical value corresponding to the length, cross-section and specific conductivity of sodium. Ten months later it measured to the same value, showing no change in distribution of the sodium at the joints or elsewhere.



Line suspended from guy-strain insulators

Apart from the cost (at 1930 prices) of poles, hardware and erection of supports the eight-conductor copper line cost $3,346.45, including the labor of pulling the 6,020 ft. of 1,000,000-circ.mil copper. This, for the 735 ft. of line length, represents a unit cost of $4.55 per foot. The sodium pipe line, 840 ft. long, cost $1,531.97 for material and labor in the experimental work and the preliminary job of filling the pipes with sodium. The pipe, the sodium and the erection labor amounted to $4,136.50 more (exclusive of supports and their erection costs). This brought the actual cost of the conductors in this pioneer line to $5,668.47, or $6.77 per foot. Eliminating the experimental items and assuming that filled pipes could be bought for the price of the pipe plus that of the sodium, the unit cost would be about $3.25 per foot. The cost of the supports for the pipe line might be more or less than the poles or other supports for the copper line, depending upon the local situation.

Lacking the availability of pipes filled with sodium, it might prove feasible to erect the whole pipe line and fill it afterward with melted sodium. In this procedure it would probably be necessary to grade the line, fill it with nitrogen and maintain it above the melting temperature of sodium (975 deg. C.) by passage through the pipe of adequately heavy current and thus have the sodium flow into place without oxidation, fire hazard or voids.



Expansion provided for only by flexible connection to station bus

Bayonet plug into sodium at end of pipe line has external projection to which are clamped flexible links to copper bus at the power plant.

Find the "No" Man First

By DEAN W. TAYLOR*
Utility Management Corporation, New York.

ONE of the first things a power salesman should do in opening a negotiation is to find that key individual in the prospect's organization who can veto the O.K. of every other man who might be sold on the utility's proposals. This "no" man will not always be the president or owner of the business, but he may be some individual on whom the president or owner relies in matters of power—he may be the general superintendent, the chief engineer or a consulting engineer. Whoever he is, the president or chief executive will consult him, and for that reason the chief executive of a concern should be contacted early in the negotiations in order to ascertain on whom the final decision will depend. This contact will also apprise the chief executive of the utility proposals and their objective and will give a chance to sell the main idea to him before he hears the other side of the story. Whether the power salesman or his boss, or the vice-president in charge of sales, should make this contact with the chief executive of the prospect is a matter to be decided by the power sales manager, but the contact must be made in a way to satisfy the head of the concern that he will be given a bona fide proposal of real merit by a power company that is able and willing to carry out its obligations.

At a meeting with the principal executive of the prospect the name of the individual who is to decide the fate of the tender will be disclosed, and it is often a good thing to ask that he be invited into the conference and told about the project in the presence of the power salesman and the head of the concern. This constitutes a warning to the "no" man that both have the same instructions and that if he fails to co-operate the power salesman has ready access to the "front office."

This meeting in the front office has the further advantage of giving the salesman an opportunity to learn what appeal—what kind of a proposition—will meet with the most favor or the least resistance. This is important. The appeal on which power is purchased is not always that of dollars saved in monthly power bills. Purchased power has many appeals and the prospect may be susceptible to any of them in addition to the mere dollar cost of energy. The principal executive may often be induced to disclose the appeal most likely to sell the job, whereas the man charged with the responsibility of the decision will often be more cautions. Never forget that a man hired to make decisions involving purchases is prone to crave credit for a good "trade." He wants his boss to think that the board of directors themselves could not have done better, if as well. For this reason the man who is to make the final decision and recommendation is not likely to show his hand at the first meeting, while his boss may be more willing to commit himself in this respect.

To sell big power to big business, begin at the top.

Money saving is not always the strongest appeal

If the meeting with the chief executive fails to develop the appeal on which power is most likely to be sold, search must be continued constantly while the engineering studies, tests and reports are being prepared. The salesman must never lose sight of the fact that figures, charts, heat balances or trial balances do not of themselves sell big power. These important foundation stones are only the foundation, a footing on which the salesman may stand while making his appeal, the point of departure for the attack—not the attack itself.

In searching for the appeal on which to hang his proposal the salesman must call upon all of his resources—education, previous experience, knowledge of the prospect's business, knowledge of the personal habits and characteristics of individuals in the plant, knowledge of operating conditions. These latter requirements call for personal observation in the prospect's plant. Do not ask your engineering department to make tests and write the reports and expect to be able to use them effectively unless you personally observe all the operating conditions covered by the test and check the figures and conclusions of the report. Do not expect the engineering department to help much in the selling. It relieves you of much detail and saves you time and physical labor, but *you* are expected to do the selling, and you can't sell if you don't know, and you won't know if you don't get out in the plant, close to the equipment and close to the men who operate it. If you try to learn all about the job and have any ingenuity you will sooner or later hit upon the kind of appeal that will strike home.

It may not be money at all, but better working conditions, improved product, freedom from responsibility for the operating head of the factory, freedom from the necessity of early investment in rehabilitation or expansion of the plant—or it may be an appeal of quite a different nature altogether, having apparently nothing to do with the "merits of the case."

The main thing is never to give up trying to find the essence of a proposal that will be attractive in its appeal.

A frequent obstacle to favorable consideration of pur-

Subjects Covered in This Series

Retaining Existing Customers.[1]
Sifting Power Prospects.[2]
Payment-Out-of-Savings Engine Contracts.[3]
Where to Begin Sales Approach.
Meeting Diesel Competition.
Process Steam — an Opportunity.
Making Power Reports Effective.
When the Odds Are Against You.
Yardsticks for Power Sales.
Power Sales Management.

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[1]*Published Oct. 22, 1932,* [2]*Nov. 19, 1932,* [3]*Dec. 10, 1932.*

chased power is the unwillingness of the prospect to disturb his organization. The engineers or firemen affected may be old employees or even relatives. They cannot be "let out," but if the salesman can show a place for them inside or outside the prospect's organization he should be able to convince the prospect that his purchase of power will work no hardship upon his men in the power plant.

A rather frequent reason for the salesman's inability to induce the prospect to adopt purchased power is the resistance offered by the chief engineer or power engineer, whose duties in the power plant will be curtailed, but not necessarily eliminated. Sometimes these men lose sight of the fact that

more savings can generally be effected in the boiler room than in the engine room.

Opportunities for reducing a plant's steam production costs are generally greater than for reducing power generating costs, because in the boiler plant the engineer is working with raw materials and the personal element enters into the labor item far more than it does in the engine room. A poor fireman can lose more of the company's money up the stack or in the ashpit than a good engine man can recover in the engine room. These facts should be pointed out to the chief engineer and to his boss. If the "chief" is competent he can earn his pay in more ways than by merely keeping tab on a few engines or turbines. Frequently he can be of real service out in the factory, where he may be able to make valuable improvements in the application and utilization of both steam and power. Impress the "chief" with the fact that as long as he stays in the engine room he is personally competing with the modern central station as an electric power producer, whereas in the boiler room or out in the factory he may be competing with relatively inferior talent, and that out there is the place for him to try to make a showing. The thing here required is to convince the "chief" and his boss that purchased power will widen rather than constrict the "chief's" field of usefulness.

The experienced power salesman will run down every possible clue to the appeal on which to base his proposal. When he has done this he will be in a better position so to shape his report that the emphasis is placed on the features that are sure to have the greatest appeal.

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Higher Coal-Burning Rates and Efficiencies With Less Maintenance

"HOW can the efficiency of combustion be increased and the maintenance of stoker parts be decreased?" were two major questions for which answers were sought by Paul W. Thompson, chief engineer of power plants, Detroit Edison Company, when starting the investigations reported at the mid-winter convention of the A.S.M.E.

The stokers on which the experiments were conducted, installed in Delray No. 3 power house in 1929, were fifteen retorts wide, 57 tuyères long and rated to burn 34,000 lb. of coal per hour with a projected grate area of 611 sq.ft. when supplied with preheated air at 350 deg. F. Each retort was equipped with six coal pushers and was divided into five sections, driven by two-speed power boxes. With this arrangement it was possible to operate a floating bank at 50,000 lb. of steam per hour, or generate as high as 430,000 lb. per hour. However, should there be sufficient change in the coarseness or moisture content of the coal to affect appreciably the rate of coal burning in a retort or section it was sometimes necessary to adjust the pusher strokes and coal feeding rate to that section, as the automatic dampers could not keep a uniform fuel bed with an improper fuel-feeding rate or improper movement of fuel from zone to zone. Owing to the magnitude of the grate and the masking action of the flame it was difficult to observe the condition of the entire fuel bed.

Combustion Improvement—The original stokers had square-nose pushers, with which the coal was not sufficiently packed at the stoker front and in the retorts. As a result combustion often occurred deep in the retorts, burning the iron and forming large clinkers over the bottom coal plates and extension grates.

To improve these conditions lower ram box caps were installed, the bottom pushers were beveled and the nose extended forward as far as possible so the ends would not extend past the tuyère line on the forward stroke. Improvement resulted, but it soon became evident that fewer pushers would deepen the retort, produce more uniform coal packing and enable the operator to maintain a uniform fuel bed with less agitation. One-piece steel plates were substituted for the sectional side-cover plates to obtain straight retort sides and allow changing the number of pushers without further stoker changes. One stoker was arranged with five pushers and another with four pushers to obtain a comparison.

The four-pusher arrangement produced a decided improvement over both the six- and five-pusher arrangement. Poorer grades of coal could be handled efficiently, with less smoke, one-fifth the coal sifting and 62-70 per cent of the stoker-drive power consumption formerly required. Four stokers are now so equipped, while the fifth still has the five-pusher arrangement installed for comparison.

Reduced Maintenance—Larger power boxes and pusher shearing pins, closer tolerances in the machine fits and a clevis-type bell crank (in place of the original bar link and cantilever pin) were provided. The main-bearing material was found to be too hard for the crankshaft journals, producing excessive wear.

Several different types of movable extension grates were tried, chiefly to reduce the burning of iron. Better air distribution and cooling of grates, combined with the ability of the long beveled pushers to remove clinkers more effectively, have reduced replacements.

The high side-wall air backs were susceptible to burn-

Maximum Coal-Burning Rates on Zone-Controlled Stokers at Delray No. 3

	10 Hour	24 Hour	Continuous
Boiler:			
Heat output, M B.t.u. per hour per sq.ft.	15.6	14.5	12.4
Steam output, M lb. per hour	430	400	340
Stoker and furnace:			
	(1)	(2)	(3)
Coal burned, M lb. per hour	45.0	41.0	34.2
Coal burned, lb. per hour per sq.ft. of projected grate area	74.0	67.0	56.0
Heat release, M B.t.u. per cu.ft. per hour	43.0	39.2	32.7
Air to stoker, deg. F.	378	375	365
Stoker and fan power, kw.-hr. per ton	30.3	26.5	21.0

Note: (1) Obtained on a stoker having the six-pusher arrangement. It is believed that with the four-pusher arrangement the Beacon Street coal-burning rate of 77.4 lb. per sq.ft. per hour can be obtained. Recent plant load has not permitted a demonstration. (2) This coal-burning rate can be obtained under any expected condition. With favorable conditions this rate may be 45,000 lb. per hour. (3) Limited by rating at which boiler tubes may be hand-lanced.

ing. Inasmuch as it was not necessary to supply air at the side higher than the plane of the tuyères, these air backs were replaced with standard half-tuyères. Replacements of these are now no greater than the full tuyères. Provision of slag deflectors on the sidewalls further protected the side tuyères and end retorts.

Automatic Zoned-Air Control—Equipment like that which had been applied experimentally at Marysville to control the air supply to different sections of the fuel bed was installed to regulate air to the four zones of each tuyère section, corresponding to the four pushers. Air for each section is brought from the plenum chamber through separate control ducts, making 56 per stoker. Neither the side rows of half-tuyères nor the extension grates are so equipped, although additional tests will determine the need of zoned air control there. A motor-operated damper is installed in each duct and controlled by the drop in air pressure in the orifice in the corresponding duct. The pressure drop in each duct is also indicated on differential gages on the boiler control board. Should any portion of the fuel bed become heavier or thinner than the remainder, the controls will increase or decrease the air pressure to the abnormal section, until it regains its proper thickness.

Excellent results from zoned fuel-bed air control have been obtained at the Beacon Street heating plant, where two boilers are equipped with manual control. These stokers are fourteen retorts wide and have 29 tuyères per retort. Each stoker is divided into three zones extending the width of the stoker. The upper zone includes the upper part of the tuyère stack; the intermediate zone the lower tuyères, and the lower zone comprises the extension grates. Maximum steaming capacity has been increased 31 per cent, maximum coal burning rate is 77.7 lb. per hour per square foot of projected grate area (including pit), and the over-all efficiency has been increased ½ per cent at high loads and about 2 per cent at low loads, compared with stokers without zoned-air control.

Stoker Performance Improves—The coal-burning rate at Delray No. 3 has been increased to as high as 45,000 lb. per hour for intervals of ten hours with proper fuel-bed conditions (see table). The over-all stoker, boiler, economizer and preheater efficiency increased from a yearly value of 82.3 per cent in 1930 to 85.4 in 1931, due to changes mentioned and partly to operating methods.

Another school of thought or practice was represented by Bert Houghton, Brooklyn Edison Company, who differed radically with the Detroit approach to the problem. He contended that deep retorts and deeply packed coal are not essential to maintaining a uniform fuel bed. With shallow retorts and loosely packed coal he has been able to bring his stokers up to a high combustion rate quicker, he claims. Balanced draft is used, one reason given being that forced draft may uncover sections of the fuel bed. Thin fuel beds reduce the fan-power requirements, he contends. With preheated air induced draft has cut down the furnace maintenance.

On the other hand J. J. Worker, American Engineering Company, pointed out that zoned-air control doubled the coal burned per square foot of grate surface at Delray No. 3 and that the changes in stokers quadrupled the kilowatts per square foot compared with Delray No. 2.

J. F. Bennett, with the same company, contended that 70-80 lb. of coal per hour per square foot of grate surface can be easily burned with zoned-air control and still maintain a uniform fuel bed. With preheated air more than 90 lb. can be burned.

Zoned-air control is the real solution to regulating very large fuel beds, declared E. L. Hopping, Philadelphia Electric Company, as indicators on the boiler control board will show the condition of the fuel bed without opening the furnace. With this control this Philadelphia company can now consume at much higher rates coal that burned very non-uniformly, clinkered and burned iron in old stokers. The rate at 250 x 10^6 B.t.u. per hour is 72 lb. per square foot, and the efficiency ranges from 81-86 per cent. Stock coal produces better results. Mr. Hopping expressed the belief that 60 lb. per square foot can be burned continuously and 70-72 lb. for four to five hour intervals. Among other improvements that permitted these results were use of carborundum blocks, bigger clinker grinders, deeper air boxes, improved pusher design, reclamation of soot, slag lips on side walls and supply of air through bridge wall.

The rate of ignition, as distinguished from rate of combustion, is not proportional to the air supply in an underfeed stoker, declared Dr. Nichols, U. S. Bureau of Mines. The higher the rate of burning the thinner the fuel bed, and consequently the greater the excess air.

I. E. Moultrop, Boston Edison Company, expressed the belief that zoned-air control is the salvation of stokers. However, he commended Mr. Houghton's method of using thin fuel beds as he is getting results. Burning of fuel is the most important economic problem in power plant operation, he contended, and purchase of stokers should not be left to purchasing agents, who buy purely on price, if the best economic results are expected.

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Engineers' Council Names Committee

Plans for the formation of a national council for engineering development, which were roughly outlined last fall, have taken more definite form with the selection of various committees to carry out the program. Seven national engineering bodies have participated in the organizing of what is to be known as the Engineers' Council for Professional Development, having for its objective the advancing of the professional status of the engineer. The new committees appointed include student selection and guidance, engineering schools, professional training and professional recognition.

Revenue Loss From Undervoltage Less Than Believed

By MERRILL DE MERIT

Assistant Chief Engineer West Penn Electric Company

BECAUSE the energy consumption of an incandescent lamp increases when the voltage impressed across it increases an improvement of secondary voltage conditions will result in an increase in consumption of kilowatt-hours by the domestic customer and an increase in the revenue which will be received. This increase in revenue is frequently estimated to be materially more than will be realized and has been pointed to as one of the material advantages which results when distribution systems are revamped or secondaries are replaced with larger wire. Unquestionably, an increase in consumption results, but there is considerable difference of opinion as to the amount of that increase.

A painstaking and expensive investigation carried on over a period of several years indicates that in practice there is a definite increase in revenue resulting from the improvement in average voltage conditions, but:

1. An accurate determination of this increase is exceedingly difficult.
2. Any determination of such a nature must extend over a period of years in order to provide the data necessary to eliminate the effects of the changes in revenue due to other factors.
3. And such increases in revenue fall within certain limits, the maximum of which is only a fraction of that ordinarily considered as the normal expectation.

Several factors contribute to make up this divergence between the actual and that normally considered as possible. Frequently the assumption is made that revenue varies as the square of the voltage impressed upon a light; that is, with an improvement of voltage of 10 per cent an increase in revenue will be realized which is proportional to the difference of the squares of the voltage before and after improvement, or about 21 per cent. However, a careful technical analysis which takes all factors into consideration and which can be made in a few days will reveal that the expectancy would be only a small part of the above. Some of these factors are:

1. The resistance of the present incandescent lamp changes with temperature, so that with a 10 per cent change in the

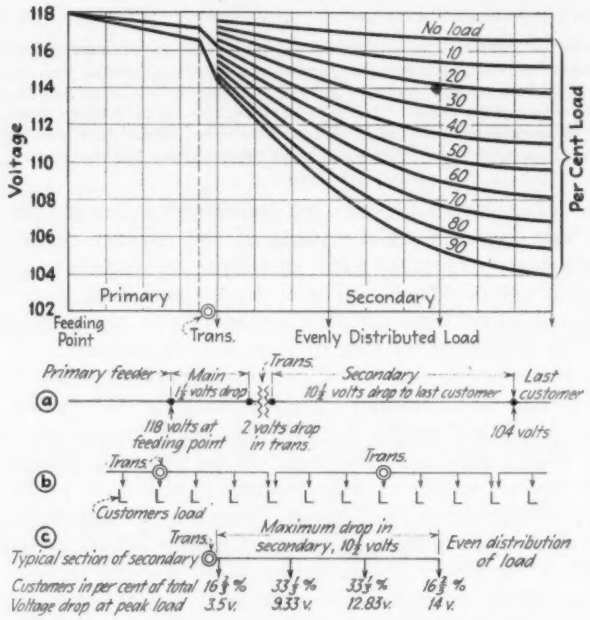


Fig. 1—Voltage drop on typical secondary for various secondary loads

(a) Section analyzed. (b) Distribution of customers along secondary. (c) Voltage drop suffered by differently situated customers during peak secondary load.

A feeder type primary circuit is used with a firm voltage at the feeding point so that recovery of voltage at the extreme customer with reduced load extends only from the feeding point. If a circuit had been used which had flat voltage at the substation bus the voltage recovery with reduced load would have extended from the extreme customer to the substation bus and the voltage recovery would be greater for the same percentage decrease in load.

With even distribution of customer connections practically 16⅔ per cent of the customers would be served off the transformer pole and 16⅔ per cent would be served from the end of the secondary; the remaining two-thirds would be served from points on the secondary located respectively one-third of its length from the transformer and two-thirds of its length from the transformer.

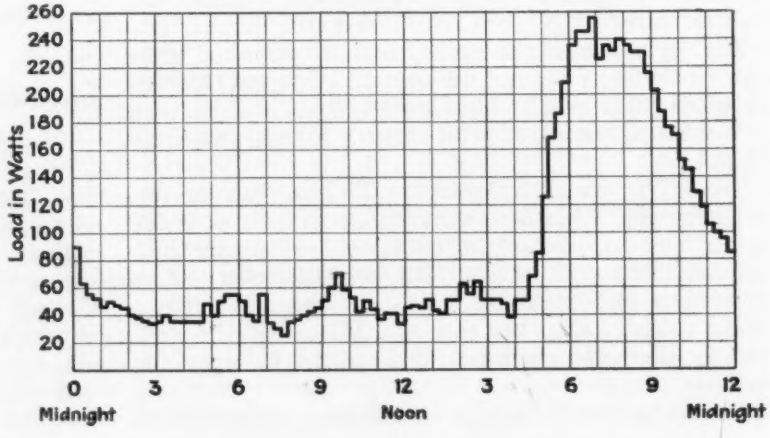


Fig. 2—Peak-day load curve of average customer

Annual consumption, 600 kw.-hr.; fifteen-minute peak demand; 255 watts. The load curve is the weighted average domestic load of the West Penn Power Company system for 1929, made up from the weighted average of three load curves which range from 284 kw.-hr. per year up to 1,272 kw.-hr. per year. The individual load curves were obtained by taking averages secured from graphic meters installed on secondaries in different typical sections for a period of years. This load curve has 8½ hours per day use of the daily peak.

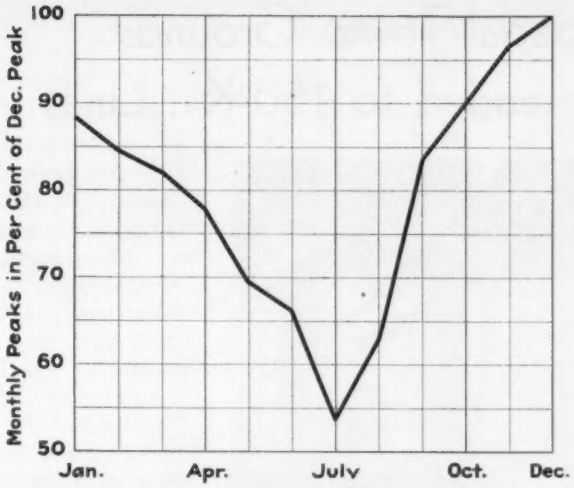


Fig. 3—Variation of monthly peak load of domestic customers over year

From Reyneau & Seelye's book "Economics of Electrical Distribution."

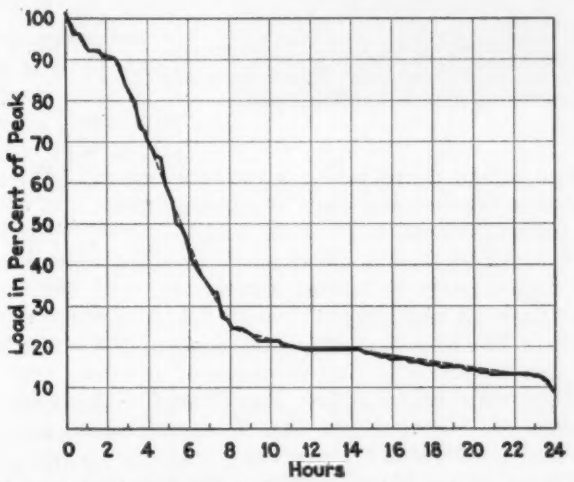


Fig. 4—Peak-day load duration of typical customer represented in Fig. 2

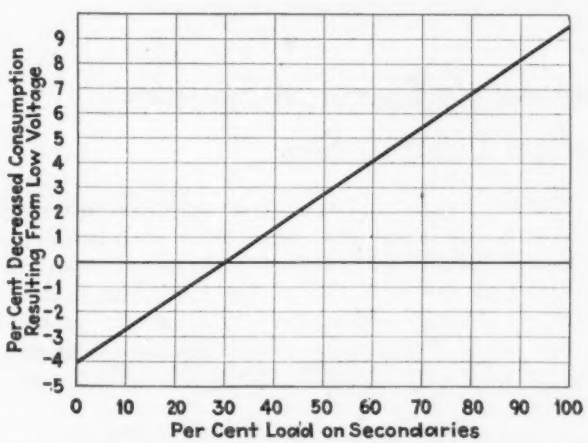


Fig. 6—Per cent reduction in consumption due to low voltage at different secondary loads

Obtained by reading from Fig. 1 the voltages at four points along secondary at different loads and calculating on Nela Park slide rule the losses in consumption due to voltage under 115 volts. When and where voltages above 115 exist, the increased consumption resulting therefrom is considered as offsetting the same amount of decreased energy consumption which may occur at other customers' installation on the same secondaries at the same time.

voltage the increase in consumption for a given period is not 21 per cent, but about 17½ per cent, as indicated by the latest information received from the Nela Park engineering department at Cleveland.

2. The percentage increase should not be based on revenue, but on kilowatt-hours, the rate of return on which will seldom approach the average due to the fact that the increased consumption will be billed at the lowest block under which the respective customers may be buying energy at each particular time.

3. The increase in consumption and revenue which is enjoyed comes in a few months of the year and almost entirely from the customers near the ends of the secondaries, and for that period of time the percentage increase in such customers' bills may be as high as 15 per cent.

Practical investigations show that where this occurs and the bills of these customers jump about 10 per cent or more, with

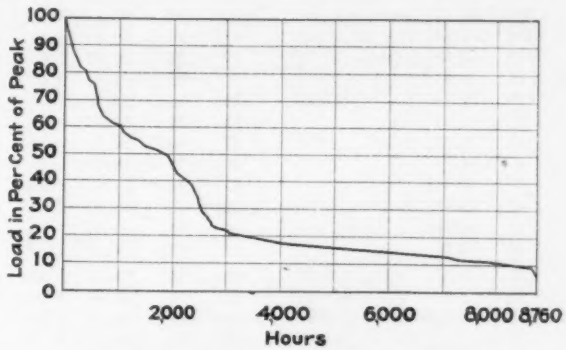


Fig. 5—Annual load duration of typical customer represented in Fig. 2

Made from the 8,760 hourly loads determined by taking 365 load-duration curves similar to that shown in Fig. 4 and using a different peak for each day as determined from the curve in Fig. 3.

neither the addition of a major appliance nor a change in habits, many of the bills will be questioned and many of the customers so affected will replace lamps with smaller lamps and turn off current to other lamps more frequently so as to reduce their light bill to a budgeted amount.

On the other hand, experience has also shown that several of these customers will comment to the company's representative on the increased bills and express a knowledge that their bills have definitely increased, but that the improvement in service is worth it.

4. The domestic load is not made up entirely of lamps and the changes in kilowatt-hour consumption for a given operation of a heating appliance, such as a range or a flat iron, does not change appreciably with changes in voltage, although the rate of consumption for a short period may vary considerably. The same is true of small motor consumption.

The accompanying technical analysis, which includes consideration of important factors, indicates that for the average condition the actual increase in revenue to be realized amounts to only a small fraction of that expected if the expectation is based on a revenue proportional to the square of the improvement in voltage at the extreme customer. The fundamental assumptions used in this analysis are as close to the practical as can be determined and at the same time have generally been made so as to show as high a percentage of increased consumption as would be obtained in practice under favorable conditions.

Conclusions—Under the assumed conditions and with all lighting load at all customers, the actual loss in kilowatt-hour consumption from the extreme customer at the time of maximum low voltage of 90 per cent is at the rate of 17.5 per cent of the consumption of that customer at that time. The average rate of loss from all customers

Calculation of Reduction in Consumption Due to Low Voltage

Per Cent of Load	Hours* of Use	Kw.-Hr. per Kw. of Peak Load	Per Cent Lost†	Kw.-Hr. Loss	Per Cent of Load	Hours* of Use	Kw.-Hr. per Kw. of Peak Load	Per Cent Lost†	Kw.-Hr. Loss
6	19	1.14			39	133	51.87	1.2	0.622
7	37	2.59			41	129	52.89	1.5	0.793
8	19	1.52			43	133	57.19	1.8	1.029
9	360	32.40			49	175	85.75	2.1	1.801
10	404	40.40			51	133	67.83	2.85	1.933
11	604	66.44			52	160	83.20	3.00	2.496
12	183	21.96			53	120	63.60	3.15	2.003
13	642	83.46			55	133	73.15	3.4	2.487
14	1,010	141.40	No loss below		56	133	74.48	3.55	2.644
15	487	73.05	30 per cent		58	46	26.68	3.8	1.014
16	825	132.00	load. because		60	129	77.40	4.1	3.173
17	294	49.98	voltage at all		61	76	46.36	4.2	1.947
18	204	36.72	consumers is		62	133	82.46	4.35	3.587
19	294	55.86	115 volts or		64	76	48.64	4.6	2.237
20	310	62.00	higher		67	31	20.77	5.0	1.038
21	21	4.41			71	45	31.95	5.6	1.789
22	228	50.16			75	46	34.50	6.1	2.104
23	85	19.55			76	75	57.00	6.25	3.562
24	22	5.28			77	42	32.34	6.40	2.070
25	43	10.75			80	31	24.80	6.80	1.686
26	21	5.46			81	76	61.56	6.90	4.248
27	43	11.61			82	74	60.68	7.10	4.308
28	42	11.76			86	31	26.66	7.60	2.026
29	44	12.76			87	31	26.97	7.75	2.090
31	21	6.51	0.15	0.010	88	45	39.60	7.90	3.128
32	22	7.04	0.3	0.021	92	46	42.32	8.40	3.555
34	133	45.22	0.6	0.271	94	30	28.20	8.70	2.453
					97	31	30.07	9.10	2.736
Total							2,400.35		64.861

$$\text{Per cent loss of kilowatt hours for year} = \frac{64.861}{2,400.35} \times 100 = 2.702 \text{ per cent}$$

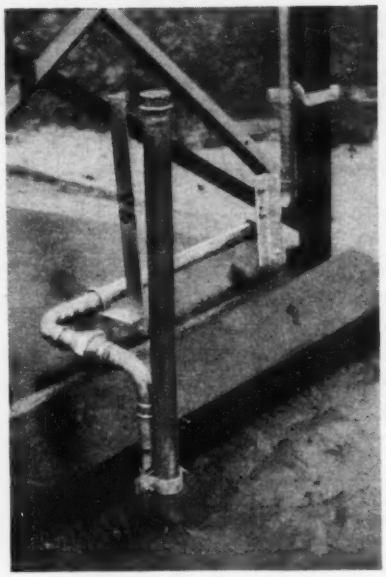
* Taken from Fig. 5. † Taken from Fig. 6.

is 9.5 per cent of their rate of consumption at that time. The percentage loss of the annual consumption of all customers would be 2.7 per cent, rather than the 21 per cent determined by taking the ratio of the square of the two voltages supplied to the extreme customer under the two conditions.

The percentage of possible increase in revenue by reason of bringing all voltages up to normal at all times would usually be of the order of half the percentage increase of consumption, or a little more than 1 per cent. This may be considerable and may frequently justify minor changes in distribution, but it seldom justifies any appreciable change unless some other contributing factor exists.

No application of these specific conclusions should be made to any individual system, of course, but another study should be made and the assumptions on which that study is based should conform to the actual conditions which exist on that system. However, it is quite apparent that a wide range in conclusions is possible unless all factors are taken into consideration.

Special Tower Grounds Extended to 150-Kv. Lines



The grounding device shown is used on all towers of Stroomverkoop Maatschappij of Maastricht, Holland, and was designed by the chief engineer, Mr. Kortlandt. To obtain as low a resistance as possible a straight pipe is driven into the ground until it reaches water, which in Holland is not very deep. Next to this pipe is driven another pipe containing copper wire the top end of which is welded to a tower member. [Wire in magnetic conduit has high surge impedance and seems inadvisable.—Editors.] This second pipe is provided with an elbow and a union permitting disconnection of the copper wire to permit measurement of the ohmic resistance of the ground when not connected to the tower. The first pipe allows checking of the water level for comparison with the resistance of ground.

This may seem rather complicated and expensive, reports M. Henriod, but Mr. Kortlandt states that extremely good results are needed and that he thinks it has been partly responsible for the practical immunity against lightning trouble during the past twenty years on an extensive 50-kv. system. Therefore this principle has been applied on the new 150-kv. line.

▼

Germany's Electrical Statistics Reflect Industry Sag

Germany's industrial activity attained its maximum in 1929 and has since that year suffered a pronounced decline. This appears from statistics reported in Special Circular No. 609 of the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, of the U. S. Department of Commerce. The accompanying tables are abstracted from that publication.

Energy Consumption in Germany

Sold by public utilities.
(Millions of Kw.-Hr.)

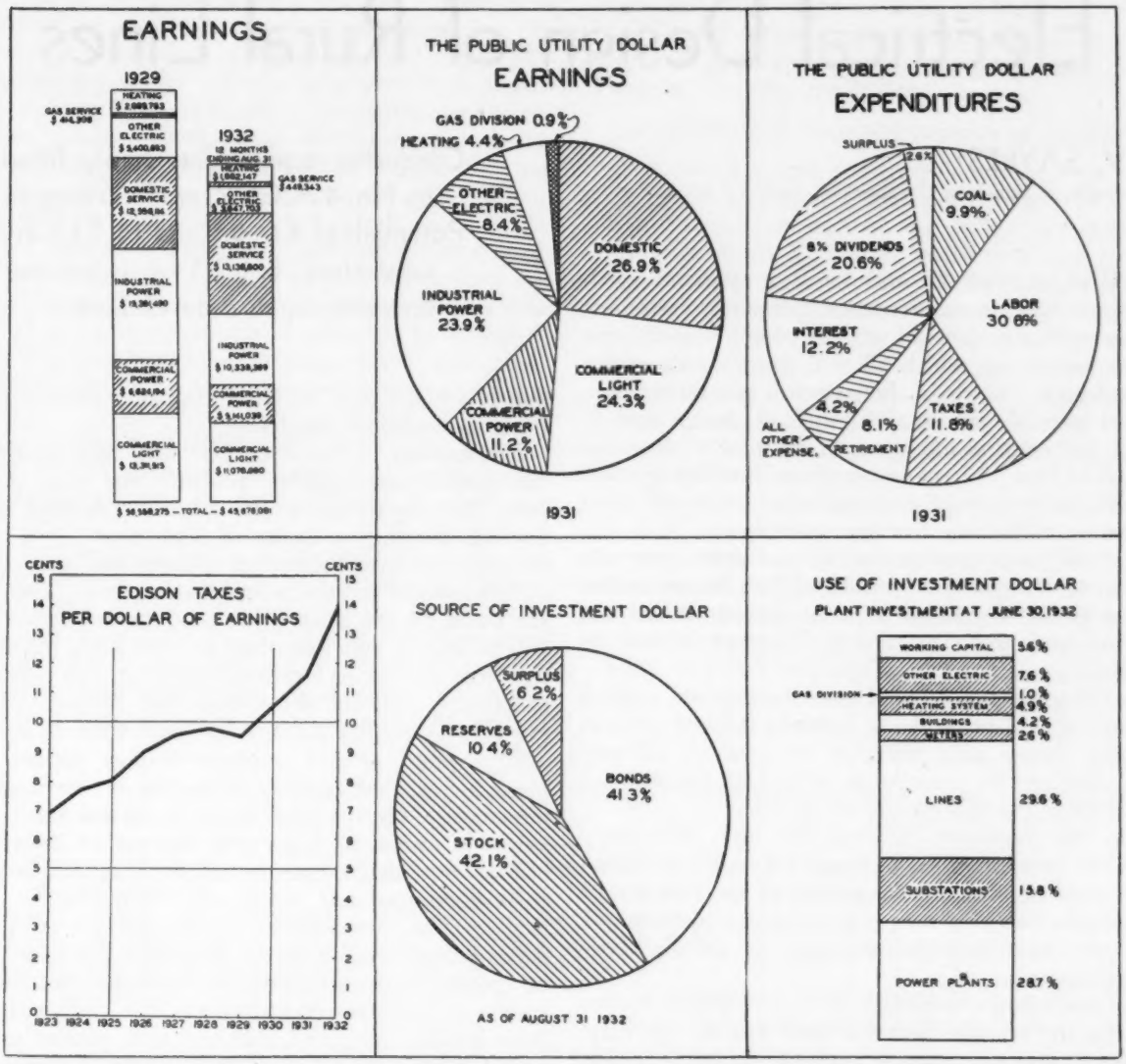
Class of Consumers	1925	1927	1928	1929
Domestic (urban)	1,440	1,920	2,180	2,640
Domestic (rural)	470	590	640	690
Commercial	50	80	100	130
Industrial	4,780	6,060	7,450	8,420
Electric railways	630	890	1,080	1,360
	7,370	9,540	11,450	13,240

German Energy Production and Generator Rating

(Public Utility and Industrial Plants)

Year	Kw.-Hr. (Millions)	Kw.-Hr. per Capita	Capacity 1,000 Kw.	Year	Kw.-Hr. (Millions)	Kw.-Hr. per Capita	Capacity 1,000 Kw.
1925	20,328	328	8,713	1929	30,660	494	12,416
1926	21,218	342	9.555	1930	28,704	448	.....
1927	25,135	405	10,243	1931	25,260	394	.....
1928	27,871	449	11,102				

Such Information Helps Public Understand



Some sage said one picture is worth more than 10,000 words, or thereabouts. It is just as true today as when uttered. Not only will more people look at pictures (and graphs), but if properly dramatized they will convey ideas quicker than words. When utilities are wondering how to convey facts to the public it is advisable to remember this. These graphs were presented by A. C. Marshall, vice-president and general manager Detroit Edison Company, with brief comments before the Detroit-Ann Arbor section of the A.I.E.E. Similar graphs on each property would enlighten the local public. Other ideas can also be presented in picture form to help the public understand a much misunderstood industry.

▼ ▼ ▼

Compound Generator Made to Serve Control and Battery

By W. C. NODDINGS

Chief Electrician Raritan Copper Works, Perth Amboy, N. J.

In the zinc plant substation of the Anaconda Copper Mining Company at Great Falls, Mont., there was a bank of Edison storage batteries used on control work which were split up and charged in parallel at 90 volts when the end cells were exhausted. For this charging work there was available a cumulative-compound generator which was ordinarily used on control work, the battery being a standby source of energy. This generator was rated at 125 volts and was very unstable on this battery load at 90 volts, even with the series field shorted out.

It seemed logical that the series field should help make the generator more stable if reversed, so a double-throw reversing switch was installed on the series field. When the generator was used on control work it was operated cumulative compound and when charging batteries it was changed to differential compound. With this change the generator proved to be very stable when charging.

The reason for this is plain. With the series field bucking the shunt field when the load starts to rise the increased series field resulting therefrom tends to lower the voltage and vice versa. If the load starts to drop off the weakened series field allows the voltage to rise until equilibrium is again established.

Should the series field be too strong in a differential-compound generator it may be necessary to add a shunt in parallel with the series field when charging batteries this way.

Electrical Design of Rural Lines

By E. V. SAYLES*
Commonwealth & Southern Corporation, Jackson, Mich.

Conductor requirements amply filled by No. 4 A.C.S.R. or No. 6 copper. Potentials of 4.6, 6.9 and 11.5 kv. are satisfactory, but 2.3 kv. is too low for extensive rural development.

DUE TO the extreme differences of opinion regarding rural line requirements (demand, customers per mile and demand per customer) it is difficult to set up factors on which all will agree as bases for rural line design. But by making certain general assumptions it is possible to fix the limits of design and to point out the relationship between customers' demands and length of line. These assumptions, justified by conclusions drawn from published and other studies of rural line operation in the past few years, are:

1. That the maximum number of customers per mile throughout the length of a rural line, if all farms, homes and other available customers were served, would not exceed ten and that the average number would be nearer five.

2. That the average demand per customer on a rural line at present will probably be between 0.5 and 1.0 kw. and in the future will probably be between 1.0 and 2.0 kw., although the maximum individual demands of certain of these customers may reach 5 kw. or more.

3. That the maximum demand per mile on strictly rural lines at present will not exceed 5 kva. per mile and that this may normally be expected to increase to 10 kva. per mile. In the future a maximum demand of 15 kva. per mile may be expected in certain well-developed districts.

The assumed data are used in the accompanying curves which show the relation between these factors for rural lines having nominal voltage ratings of 2,300, 4,600, 6,900 and 11,500 volts.

From these curves it is possible to determine the maximum miles of line which can be served at a given voltage, assuming a certain number of customers per mile and a certain demand per customer based on a certain conductor size. Or, knowing the length of line and the number of customers, the maximum demand per customer permissible can be determined for a given conductor size. Thus, knowing any one independent variable, the limits of the assumed variables can be determined.

From a study of these curves it is evident that a surprisingly large load per mile can be carried, even with the smallest size of conductor which is suitable from the standpoint of mechanical strength. For instance, using a single-phase line of the smallest suitable conductor (which is No. 4 A.C.S.R. or No. 6 copper), it is possible to carry loads in excess of what may be expected over lengths greater than are now in use. The effect of increasing conductor size is also shown, which indicates the relatively slight benefit to be obtained by an increase from the minimum size to No. 2 A.C.S.R. (No. 4 copper equivalent). It should be evident from these curves that No. 4 A.C.S.R. or No. 6 copper is more than ample from an electrical standpoint.

Preparation of these curves obviously required certain specific assumptions, probably the most important being that the voltage at the substation serving the rural line will not vary in excess of 5 per cent. It is true that in many instances substation voltages may vary in excess of this amount and the reverse is also true. These curves are based on the assumption that the substation voltage will be less at full load than at light load, but it is also true that in certain localities the substation voltages are practically constant throughout the 24-hour period or are slightly higher during full load than at light load, which would greatly improve voltage conditions and hence increase the capacity of the line as determined from the curves. On the other hand, if the substation voltage varies in excess of 5 per cent the curves shown on the basis of no-voltage regulator in the circuit will be changed correspondingly and result in a reduction in line capacity. The curves shown on the basis of voltage regulators being installed on the rural line, however, will not be changed for substation bus voltages considerably in excess of the 5 per cent assumed. In fact, with a regulator installed on the circuit and with proper substation transformer taps its capacity is almost independent of substation voltage fluctuation.

These curves also allow for the transformer drop and drop in secondary wiring to the customer's meter. This value is assumed to be 2 per cent. It is true that this may vary depending upon actual conditions. However, it is felt that this will represent the average. It is assumed that the voltage of the customer's meter is nominally 115, with 123 volts as a maximum and 109 as a minimum.

Effect of branch lines

It is evident that the term "demand per mile" involves the total demand of the entire circuit and the total length of the circuit, including the trunk line and such branch lines as are necessary. The effect of these branches, which are tapped off the trunk line, is exactly the same as that of connecting additional customers along the trunk line; i.e., to all practical purposes, the demand per mile of the trunk line is increased.

The effect of adding branch lines and so increasing the effective demand per mile of the trunk line is to shorten by some amount the permissible length of the trunk line as determined by the curves. Just what effect the branch lines will have depends upon their loading and the distance from the substation to the points at which they are connected, it being evident that the smaller the

**Adapted from paper to overhead systems committee, Great Lakes Division, N.E.L.A.*

branch line load and the closer it is to the substation the less will be its effect on the trunk line. A study of this problem shows that branches of only a mile or two will have but little effect on the trunk line length, particularly for the higher voltage lines; neither will their effect be noticeable if the branches are rather close to the substation. Even though the maximum permissible length of trunk line be shortened, as branch lines are added, the total mileage of line comprising the circuit will naturally increase; the area served will also increase.

It is not possible to make any exact statements regarding the necessary reduction in length of trunk lines due to the addition of branch lines, or the increase in total mileage of line comprising the circuit; this is dependent upon the number, length and arrangement of the branch lines, which cannot always be arranged in the most desirable manner.

However, a study of several commonly used arrangements of branch lines will show that, for any given circuit having demands of 5 or 10 kva. per mile, the total mileage of circuit served by one trunk line and its branches may be from five to three times the maximum permissible length (as determined from the proper curve) of a line having no branches.

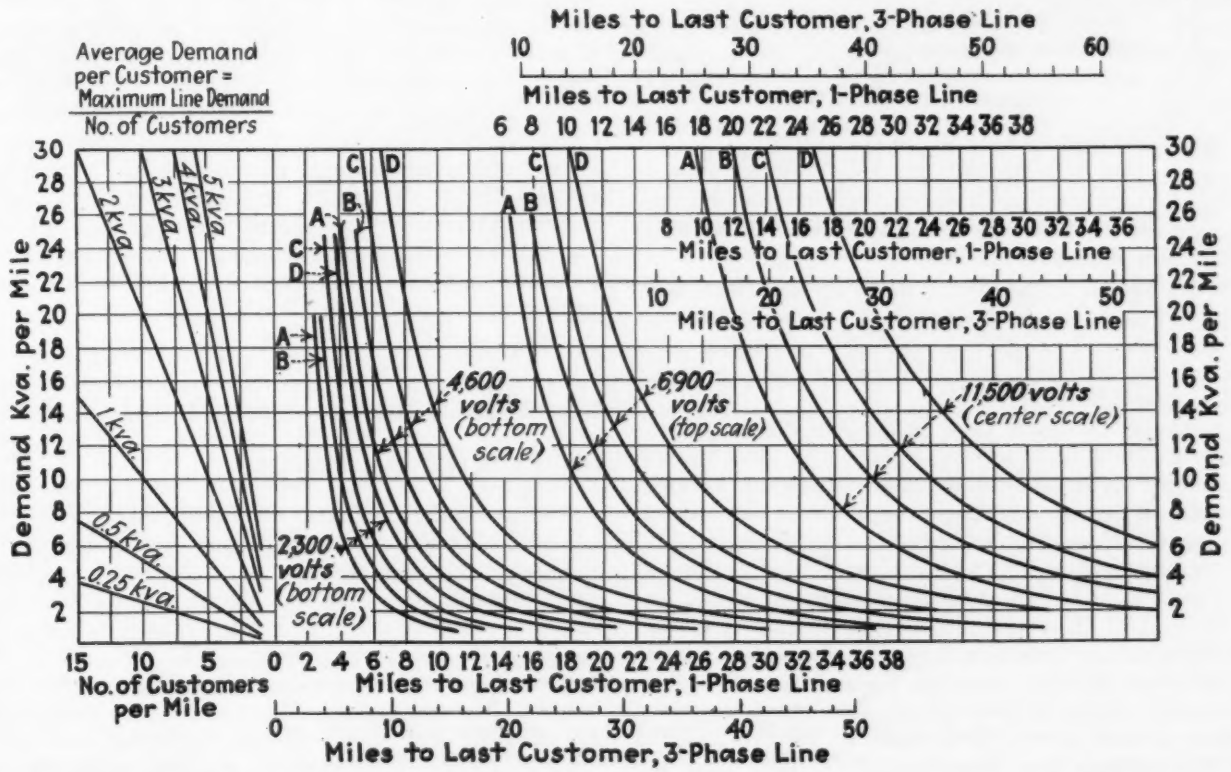
The higher factor applies to the higher voltage lines having the smaller loads and the lower factor to the lower voltage lines having the larger loads. The most desirable and most economical arrangement of branch lines is that in which the branches are connected to the trunk line at a point as close to the substation as is feasible and follow routes parallel to that of the trunk line to as great an extent as practical, thus acting, in a sense, as auxiliary trunk lines.

Methods of increasing capacity of rural lines

In considering the construction of any new rural line it is generally assumed that the line will be of single-phase construction and of the voltage available in the district in which it is to be built, provided voltages of 4,600 or higher be available. If the voltage available at the distribution substation does not vary excessively, it will probably be unnecessary to install voltage regulating equipment. The first step in the development of a rural distribution area, therefore, consists of simply building a single-phase line of adequate construction, using the minimum size conductor, which is No. 4 A.C.S.R. or No. 6 copper.

As the loads on the line increase, or as the line is extended, voltage drop will increase possibly to the point where it will be necessary to compensate for this drop in order to maintain satisfactory voltage at the more distant customers. At such a time it would be possible to increase the line capacity by one of two or three methods.

First, it would be possible to install a single-phase induction voltage regulator at the substation, thereby permitting a greater voltage drop in the line, which would


Miles to Last Customer, 3-Phase Line
Average Demand per Customer = Maximum Line Demand / No. of Customers
Miles to Last Customer, 1-Phase Line
Demand Kva. per Mile
2 kva.
3 kva.
4 kva.
5 kva.
1 kva.
0.5 kva.
0.25 kva.
4,600 volts (bottom scale)
6,900 volts (top scale)
11,500 volts (center scale)
2,300 volts (bottom scale)
No. of Customers per Mile
Miles to Last Customer, 1-Phase Line
Miles to Last Customer, 3-Phase Line

Allowable line lengths and conductor performances for rural lines of different voltages

Basic Assumptions:

Volts at substation bus (unregulated)
- At light load (× distribution transformer ratio) = 123
- At heavy load (× distribution transformer ratio) = 117

Volts at customer's service entrance, permissible limits
- Maximum (base voltage × 1.07) = 123
- Minimum (base voltage × 0.95) = 109

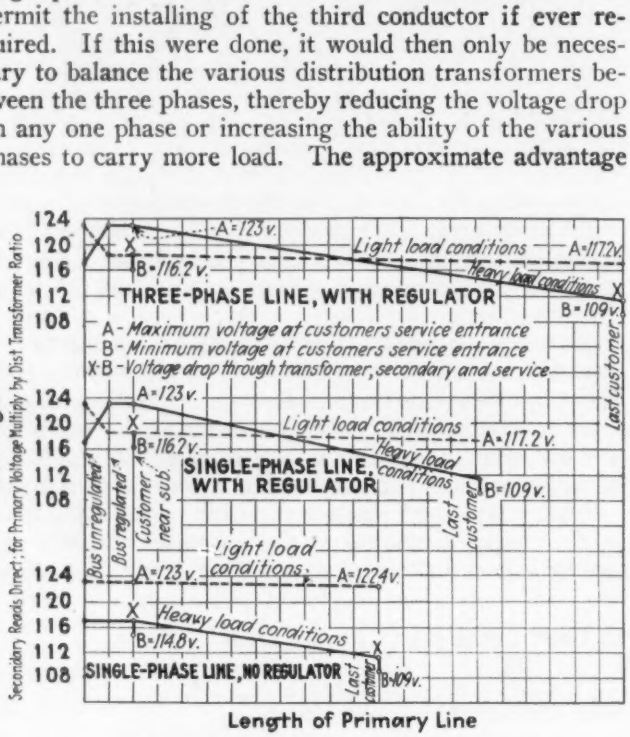
Voltage drop through transformer, secondary (if any) and service drop at heavy load, average, per cent = 2

Loads ..... Uniformly distributed
Power factor 0.8
Equivalent conductor spacing, ft.
- Single-phase lines 5
- Three-phase lines 3.5

A—No. 4 A.C.S.R. or No. 6 copper conductor—no regulator in circuit
B—No. 2 A.C.S.R. or No. 4 copper conductor—no regulator in circuit
C—No. 4 A.C.S.R. or No. 6 copper conductor—with regulator in circuit
D—No. 2 A.C.S.R. or No. 4 copper conductor—with regulator in circuit

be automatically compensated for by the regulator. The advantage to be gained by such an installation is obvious from reference to the curves.

Second, it would be possible to increase the line capacity by installing a third line conductor throughout the length of the line, it being assumed that the original single-phase line would be of such construction as to permit the installing of the third conductor if ever required. If this were done, it would then only be necessary to balance the various distribution transformers between the three phases, thereby reducing the voltage drop on any one phase or increasing the ability of the various phases to carry more load. The approximate advantage



Voltage conditions on rural lines

(See basic assumptions under Fig. 1)

to be gained in changing a single-phase line to three phase is also shown on the curves.

Third, it would be possible to increase the line capacity by some amount by changing to a larger conductor size. The advantage to be gained from this change is very small, as can be noted from the curves, and is hardly worth consideration.

The relative merits of these methods of increasing line capacity can best be judged on the basis of their relative cost and inconvenience to operation during the changes required. When an increase in capacity of the original single-phase line is required there is little doubt but that an induction voltage regulator should be installed at the substation, if it had not been installed when the line was first built. If at all possible, the regulator should be installed at the outset on the basis of substation voltage variation, thereby removing the uncertainty of line capacity due to substation voltage fluctuation when the regulator is not used. Theoretically, however, if the substation voltage does not exceed 5 per cent total, the use of a regulator at the outset is not essential.

As for increasing line capacity by adding a third phase, this is without doubt rather costly and objectionable from the standpoint of requiring frequent interruptions to the line in service during the installation of the new conductor. In the case of any appreciable length of line the cost will probably exceed that of a single-phase voltage regulator, especially in the lower voltage ratings.

If the capacity of a rural line must again be increased after a single-phase voltage regulator is installed it would then be desirable to install the third phase, balancing the loads on the three phases. At this time it would be desirable to add another single-phase regulator at the substation, making a total of two regulators, which will provide suitable voltage regulation for a three-phase line.

Summarizing, it would seem that the logical steps in the development of a rural line would be as follows:

1. Build a single-phase line of adequate mechanical construction using No. 4 A.C.S.R. conductor. No voltage regulator need be installed at the substation if the variation in substation voltage is not excessive.

2. Install a single-phase induction voltage regulator at the substation without making any line changes.

3. Install a third wire on the line and install a second single-phase induction regulator at the substation, making the line a completely three-phase regulated circuit.

Distribution voltages

Little has been said regarding the actual distribution voltage to be used for serving rural customers. Obviously, this is usually a question of what distribution voltages are available in the district in which the line is to be built. Reference to the curves, however, plainly shows the merits, from the standpoint of line capacity, of the higher voltages. Conclusions can readily be drawn to the effect that 11,500 volts and 6,900 volts make very desirable voltages for use in rural construction, in that the capacity of such lines, even with the minimum conductor size, is in excess of what may usually be expected. A rural line operating at 4,600 volts also has adequate capacity to serve rural loads in excess of what are now being experienced and provides for considerable growth, especially if proper voltage regulation is maintained. It is evident that rural lines operating at 2,300 volts, while suitable for short lengths and small loadings, are not entirely satisfactory, although the operation of short lines at this voltage, especially when lightly loaded, may be desirable pending the time when the voltage can be increased.

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Portable Rectifier Substations for Foreign Railroads

Two portable 2,000-kw., 2,900-volt mercury-arc rectifier substations have been purchased by the Italian State Railways for emergency service on the Bologna-Florence electrification, according to Nikolay von Kotschubey of Zurich. They are designed for connection to 60-kv. lines and for the following overloads: 20 per cent for two hours, 50 per cent for one hour and 100 per cent for one minute. The substations measure 16.9 m. over buffers, 4.3 m. high and weigh 45 tons including the outdoor natural cooled transformer, rectifier, mercury-vapor pump, cooling system and circuit breakers.

The German State Railways likewise has decided to use a portable rectifier substation, it being rated at 2,400 kw., 800 volts for connection to 33-kv. lines. During rush-hour traffic it is used to share the load of suburban lines. Such substations, Mr. Kotschubey points out, permit the supply of variable traffic demands without providing peak capacity in stationary substations that would be only partly loaded normally.

Men of the Industry

J. N. Shannahan Heads Midland United Company

John N. Shannahan of Omaha has been selected for the position of president of the Midland United Company and chief executive officer of its subsidiary companies, to succeed the late Robert M. Feustel. Mr. Shannahan will assume his new duties on January 1 with headquarters in Indianapolis. He will become the ranking officer of the Midland United Company. The vacancy caused by the resignation of Samuel Insull as chairman of the company several months ago will not be filled. Samuel Insull, Jr., is also expected to retire as vice-chairman of the company, although he probably will remain a member of the board of directors.

It is a large undertaking that Mr. Shannahan will direct—one of the biggest of its kind in the country. But the man is superbly qualified for the task as an engineer, as an executive and as an astute conciliator. The rise of a man who has been president of the American Transit Association, who during his term of office in that position had a large part in perpetuating the work of the committee of 100, formed during the war-time period, by fostering the advisory council of the association, of which council he had since 1928 been chairman, who is now a regional director of the United States Chamber of Commerce and who at Omaha five years ago took over a public utility that was not much of a utility but was all too public, has not been rapid. His career has been one of steady, if slow, growth, of one responsibility after another, each more difficult than the other and each calling for the exercise of all the talents of the man as an engineer, as an executive and in the field of public relations.

Despite the wealth of the man's experience, the task that Mr. Shannahan now assumes is his biggest responsibility. And that is saying a great deal in the light of his previous responsibilities and achievements. As an engineer and as an executive Mr. Shannahan has had experience with all the types of service rendered by the Midland United companies—railway, gas, electric light and water.

Mr. Shannahan began his public utility career as chief engineer of the Edison Electric Light & Power Company and the Fonda, Johnstown & Gloversville Railroad in New York, his native state, both controlled by the same interests. Later he became general superintendent and then general manager of these properties. In 1903 he was elected president of the Adirondack Lakes Traction Company. From 1907 to 1911 he was vice-president and general manager of the Washington, Baltimore & Annapolis Electric Railway, relinquishing these duties to become manager of railway operations for J. G. White & Company, owners of utility properties in various parts of the country. In 1912 he was named vice-president and general manager of the Newport News & Hampton Railway Gas & Electric Company and was elected president of that company in 1916. He remained there until he went to Omaha five years ago.

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W. F. Sims Assumes New Technical Duties

W. F. Sims has been appointed electrical engineer of the Commonwealth Edison Company, Chicago, to succeed the late R. F. Schuchardt. Prior to last July, when the engineering department was reorganized, Mr. Sims has been engineer of inside plant. At that time both he and P. F. WILLIAMS, formerly engineer of distribution, were appointed assistant electrical engineers in charge of design and field engineering respectively and G. M. ARMBRUST became system development engineer. Mr. Armbrust has now been appointed assistant electrical engineer in charge of design in place of Mr. Sims and has been succeeded by H. E. WULFING as system development engineer.

Mr. Sims is well known in the electrical engineering field, having long been identified with activities of the American Institute of Electrical Engineers and the National Electric Light Association and is now chairman of the electrical apparatus national committee of N.E.L.A. After graduation from the Armour Institute of Technology in 1897 and following four years with the Chicago Telephone Company he entered the Edison organization, where he remained for five years. From 1907 to 1916 he was associated with the unification of the Chicago surface transportation lines and for five years of this period was with the Stone & Webster Engineering Corporation. It was in 1916 that he again became identified with the Commonwealth Edison Company.

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OBITUARY

William H. Patchell

William H. Patchell, prominent as a consulting mechanical and electrical engineer in England and well known to the engineering profession in this country, which he frequently visited, died November 24 at Beckenham, England, at the age of 70. A native of Lincolnshire, Mr. Patchell was educated at King Edward VI Grammar School, Louth, and by private tuition. After spending some years in the electrical manufacturing industry, he was appointed engineer-in-chief of the Charing Cross & Strand Electric Supply Company, London, and after an association of thirteen years resigned his position in 1906 and commenced practice as a consulting engineer. He specialized in the use of electricity in mines and acted in a number of important arbitrations, with considerable success. In recent years he performed the useful duty of making British engineers better acquainted with the advances taking place in the design and construction of power plants in the United States. Mr. Patchell was a past-president of the Institution of Mechanical Engineers, a past vice-president of the Institution of Electrical Engineers, a member of the Institution of Civil Engineers, a fellow of the American Institute of Electrical Engineers and a member of many other societies.

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ALBERT O. HUNT, for the past twenty years assistant general manager of the London (Ont.) Public Utilities Commission, died November 21, at his home in that city, after a week's illness. Mr. Hunt, who showed an early aptitude for electrical work, joined the Royal Electric Company at Montreal in 1888. He served with that company until 1894, when he returned to London to become superintendent of the Canadian General Electric Company plant there, which then operated what later became the London Electric.

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THOMAS P. MCCREA, formerly an officer and a director of the Los Angeles Gas & Electric Corporation, died November 25 at his home at Los Angeles

in his sixty-second year. Mr. McCrea, in 1893, became an accountant for the Los Angeles Gas Company and remained as a member of that organization until his retirement from business in 1928. During his 35 years of service with the corporation he advanced from accountant through the positions of auditor, purchasing agent and assistant secretary, becoming secretary in 1916. He was elected a director of the corporation in 1920.

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LOUIS H. CHAPMAN, formerly water and light commissioner in Kansas City, Kan., and more recently identified with the Insull interests in Kansas, died Nov. 24 at his country home near Gardner, following an illness of more than eighteen months. Mr. Chapman was appointed to public office in October, 1913, and was elected five consecutive times, finally resigning to become manager of the Fairfax industrial development. The municipal plant in Kansas City was his hobby and it was largely due to his efforts that it operated so successfully. Mr. Chapman was born at Hartford, Conn. His first work in the electrical industry was with the Commonwealth Edison Company of Chicago. He was 58 years of age.

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WILLIAM S. BERRY, well known in the electrical contracting field and for many years sales manager and manager of the San Francisco branch of the Graybar Electric Company, died December 2, at his home in San Francisco, after an illness of two years. A native of Louisville, Ky., Mr. Berry obtained his early experience with the General Electric Company and its predecessors. In 1904 he joined the New York staff of Western Electric Company as a power apparatus specialist, and three years later went to Cincinnati as branch manager. In 1908, during the reconstruction of San Francisco after the fire and earthquake, he was appointed sales manager of that office, subsequently was made manager of the San Francisco branch and, three years ago, assistant Pacific division manager. One of the founders of the San Francisco Electrical Development League and of the California Electrical Co-operative Campaign and its successor, the Pacific Coast Electrical Bureau, Mr. Berry was recognized as one of the coast's leaders in this type of activity and he was the recipient of the certificate of honorable mention under the James H. McGraw award for 1926, "in recognition of his splendid record of constructive contribution to the wholesaling branch of the electrical industry." He served on various committees of the Pacific division of the National Electrical Wholesalers' Association and was chairman at one time. He was president of the San Francisco Electrical Development League and was a member of the Telephone Pioneers of America.

New Equipment Available

Compound Timer for Intermittent Operations

Known as the compound timer, an induction disk motor-driven timing device or interrupter designed for operations requiring very brief periods of circuit closure, or opening, separated by relatively long time intervals, is announced by the Eagle Signal Corporation, Moline, Ill. The distinctive feature of this timer is that it will permit close adjustment of the short time interval in a relatively long cycle of operation. Such an adjustment is difficult to make on most timers of conventional design, equipped with but a single driving motor. The motive power of the compound timer is furnished by two induction disk motors, one of which determines the duration of the long interval and is termed the primary motor. The other motor determines the duration of the short interval and is termed the secondary motor. Both the long interval and the short interval may be easily varied by means of simple adjustments that regulate the speed of the motors.

The compound timer is suitable for operating motors intermittently driving air-cleaning equipment or conveyors, etc. Timer contacts are rated 15 amp. a.c. Standard timers are available for ranges of ½ to 24 hours in the long interval and from 80 to 150 seconds in the short interval.

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Electric Steam Generators Made in Small Sizes

To complete its line of electric steam generators (or boilers) for producing small quantities of steam at high or low pressure, the Commonwealth Electric & Manufacturing Company, Boston, Mass., announces the marketing of 2, 3, 4 and 5-kw. sizes, corresponding to 6, 9, 12 and 15 lb. of steam per hour. The apparatus will operate on any electrical circuit from 110 to 250 volts, and standard sizes are designed for pressures of from 0.5 to 100 lb. gage. Higher pressures are built to order. Previous ratings extended from 7.5 to 90 kw. in larger units. Applications are made in numerous industrial, laboratory and commercial fields where long steam lines are inefficient and otherwise undesirable.

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FULL VOLTAGE MAGNETIC SWITCHES which are weatherproof as well as being suitable for use in corrosive atmospheres are announced by the General Electric Company. The new devices consist of standard General Electric magnetic switches with special operating coils and contact tips for operation under oil and an oil-immersed temperature overload relay.

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Heavy-Duty Metal Immersion Heaters

Chromalox heavy-duty metal immersion heaters now available in welded casings of iron, steel, stainless steel and a wide variety of other metals to meet or fit specific conditions are announced by the Edwin L. Wiegand Company, Pittsburgh, Pa. A number of ratings are available, not only for heating of the so-called white metals but for everything that melts or is processed below 1,000 deg. F. The welded construction permits any desired variations in shape to accommodate heating units to the contour of process vessels.

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Electrically Operated Air Circuit Breakers

Manually and electrically operated, trip-free, multi-pole air circuit breakers for the control and protection of circuits in all fields have been announced by the General Electric Company. The ratings of this new apparatus range from 15 to 400 amp., 250 volts d.c. and 600 volts a.c. This type of breaker has high interrupting capacity because when the breaker opens the circuit is transferred from main contacts to intermediate contacts and then to arcing horns by the rapid action of a magnetic blowout incorporated in the breaker.

Two independent overcurrent tripping devices are included, a thermal inverse time trip and an instantaneous magnetic trip which operates instantly on approximately ten times the normal current.

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TO MEET A DEMAND for a more satisfactory flasher for small signs, Reynolds Electric Company, Chicago, Ill., has developed a new DMO mercury flasher. It is made with one or two circuits to flash on or off, alternate sides, or two colors with overlapping, and is equipped with one or two mercury tubes capable of handling a 30-milliampere, 15,000-volt transformer or 1,000-watt lamp load per tube. This flasher may be obtained for either 110-volt or 220-volt, 60-cycle or 50-cycle service.